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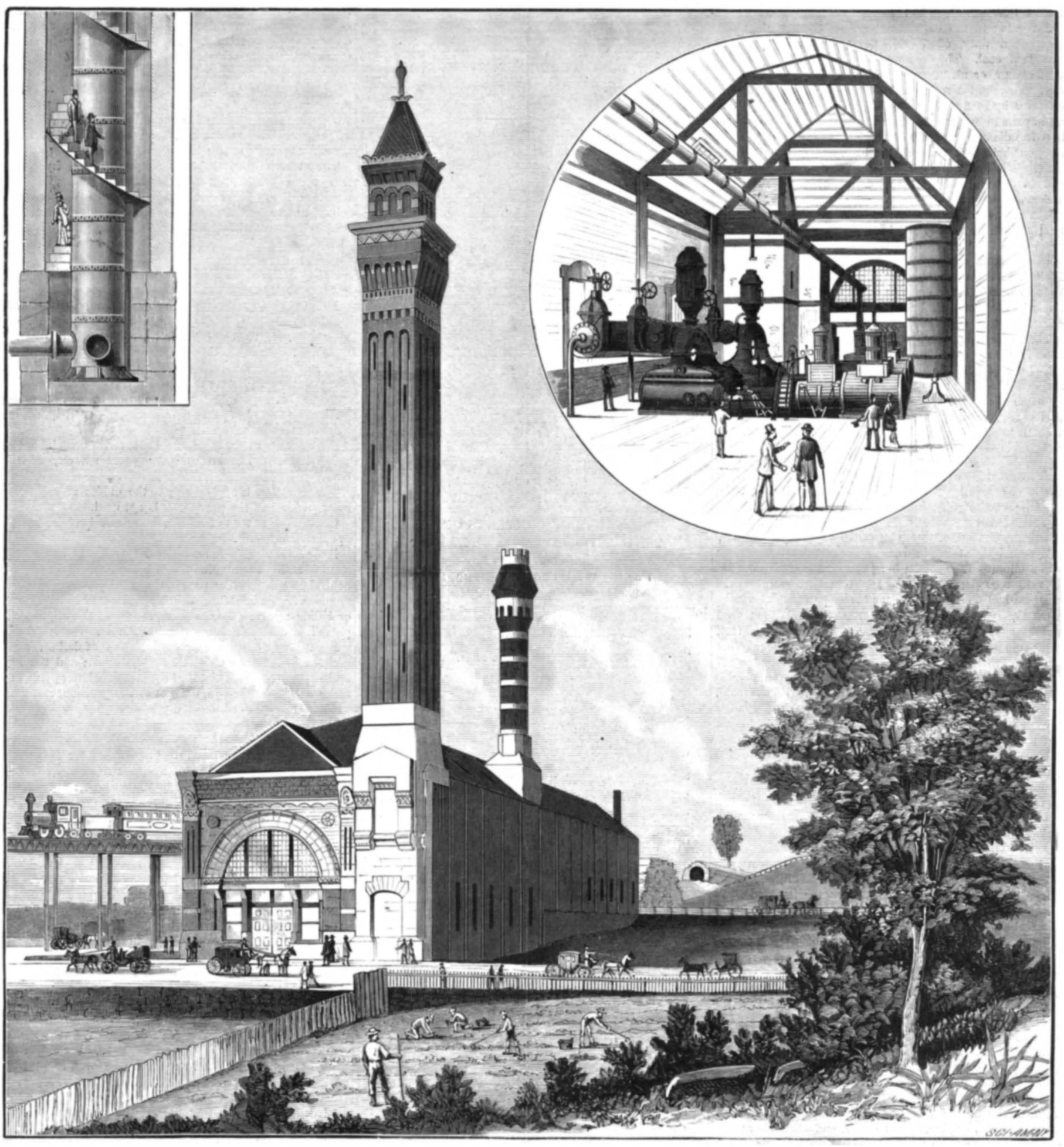
THE NEW HIGH-SERVICE PUMPING WORKS, NEW YORK CITY.

We give interior and exterior views of the new high-service water works which supply all of the higher portions of New York city with water. The architectural design of the building is so well shown in the engraving as to need no description. The tall tower contains the iron stand pipe which gives the head necessary to force the water to the highest point in the city.

The works were built in 1879, under the supervision of the Department of Public Works, of which Mr. Isaac Newton is Chief Engineer. The construction was carried on under the immediate supervision of Mr. G. W. Birdsall, assisted by Mr. Jno. E. McKay.

The Worthington pumping system was selected as being the most desirable on account of its simplicity, the directness of its action, and its peculiar adaptability to the work. Although we have on one or two occasions described the Worthington pumping engines, we will give some of the particulars of its construction and working.

The valves for both cylinders of each engine are arranged on the same stem by raising the chest of the smaller, and each valve is provided with a balancing piston. The valves of one engine are operated by bell cranks directly from the reciprocating parts of the other engine, and no rotary movements with accompanying complications are required. Double cylinder ports are provided; the outer ones receive steam past the ends of the valves, and admit it to the cylinder in the usual way. The inner ones communicate with the exhaust cavity of the valve only, and enter the cylinder at such distances from the ends that, when steam is exhausting through one of the ports, the main piston will run over and close it, and cushion upon the steam thereby inclosed,



THE NEW HIGH SERVICE PUMPING WORKS AT NINETY-EIGHTH STREET AND NINTH AVENUE NEW YORK CITY.

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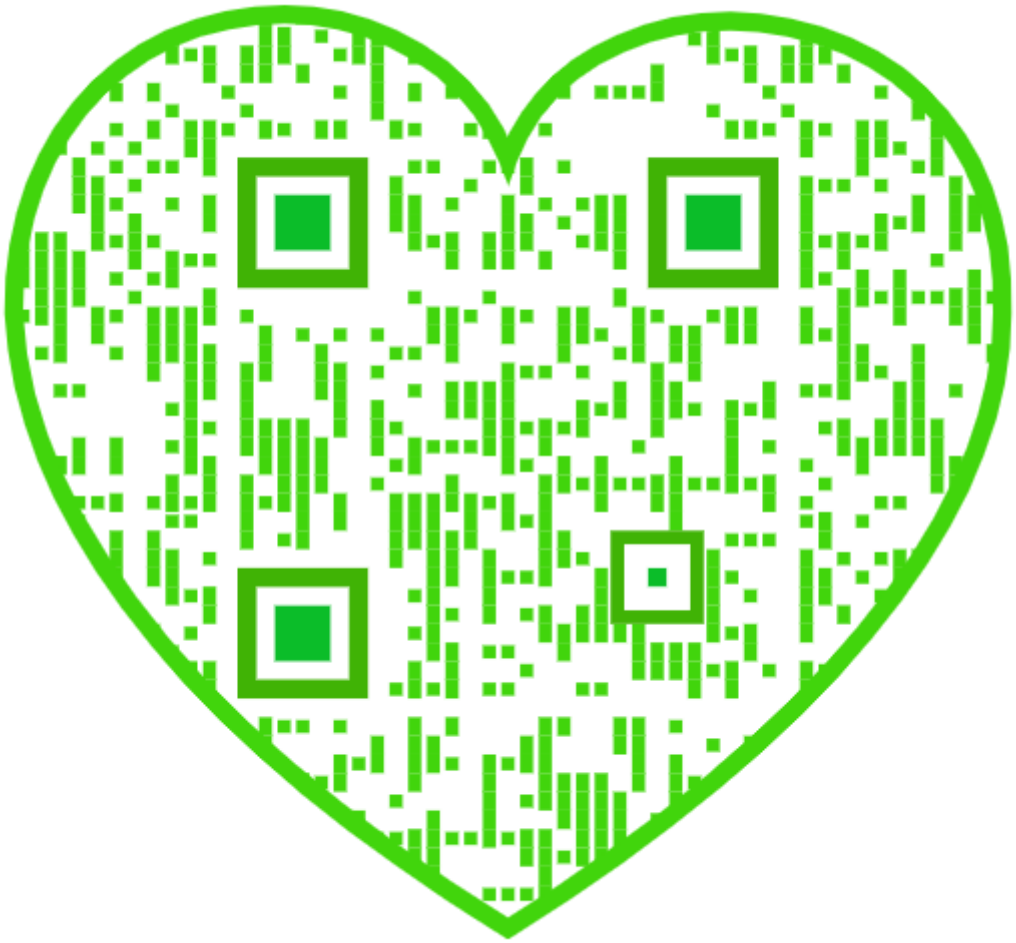

the outer port being at the time shut off by the main valve. Valves are provided to put the two cylinder ports at each end in communication to regulate the extent of cushioning. The pump valves consist of rubber disks arranged in chambers above and below the plungers. Each plunger runs without packing in a long grooved ring in a central diaphragm. In operation, one engine, while in full action, moves the valves of the other, when the pistons of the latter gradually begin to move and finally attain full velocity, as those of the first are checked by the steam cushions, and gradually come to rest, the pump valves meantime seating quietly.

The first engine pauses a moment till the second engine admits steam, when it commences a return stroke, and the second comes to rest—the action of one blending into that of the other as each alternately takes up the load—the result being that the discharge is uniform, a uniform pressure is maintained in the main, and the pumps under heavy or light pressure operate without jar or noise.

In the Ninety-eighth Street works there are two compound condensing Worthington pumping engines, each capable of raising 7,500,000 gallons 100 feet high in 24 hours. This is equivalent to 132 horse power each. The high pressure cylinders are 21 inches diameter; the low pressure, 36⅜ inches; water plunger, 26 inches diameter; all 48 inches stroke. The high pressure cylinders have cut-off valves in the steam ports, so that part of the expansion takes place in the small cylinder. This is a new feature introduced for the first time on this engine.

According to the department report, these engines are showing a duty of 70,000,000 foot pounds with 100 pounds of coal. They are pumping over 8,000,000 gallons per 24 hours, or about one-eighth more than contract capacity. There are 4 return flue tubular boilers, each 6 feet diameter by 16 feet long, with 75 4-inch tubes. They are set in pairs in brickwork. The stand pipe on delivery main is 6 feet diameter and 150 feet high. It is made of boiler iron, one-half inch thick at the base, and thinner toward the top. The tank on the suction pipe is 8 feet diameter and 44 feet high. Suction and delivery pipes are each 36 inches in diameter.

The engine and boiler house extends from Ninety-seventh to Ninety-eighth streets, and is 50 feet by 200 feet, and has room for a third engine and more boilers. In connection with the main engines there is a Worthington pump of 16 inch steam cylinders, 10¼ inch water cylinders, and 10 inches stroke, which returns the water of condensation of the large engines back into the mains. This small pump exhausts into the condensers of the large engines.

The water is supplied to these works through a 36-inch main from the Central Park reservoir.

Taken all in all, this system of pumping is as fine an example of the direct and economical application of the power of steam as could be desired. The pumping proceeds with perfect regularity, without noise or jar, and is accomplished without rotating shafts, wheels, or gearing of any kind.

The Fastest Steamer.

A recent trial of the new Clyde built steamer Stirling Castle gave results upon which her owners claim her to be the fastest ocean going steamer in the world. Six consecutive runs at the measured mile gave a mean speed, on the Admiralty method, of 18·418 knots, or $21\frac{8}{10}$ miles per hour. The actual time taken in running each mile respectively was 3 minutes 13 seconds; 3 minutes 23 seconds; 3 minutes 12 seconds; 3 minutes 18 seconds; 3 minutes 13 seconds; and 3 minutes 18 seconds.

On the trial there was a cargo of 3,000 tons dead weight on board. Her length is 430 feet, breadth 50 feet, and depth 33 feet, and she registers 4,300 tons. Her engines are of the three cylinder type, and have developed 8,237 horse power. The diameter of the high pressure cylinder is 62 inches, and the two low pressure 90 inches, with a 5 foot 6 inch stroke. Surface condensers are used with Gwynne's "Invincible" circulating pumps. The boilers are of steel, and present a total heating surface of 21,161 feet; the grate surface is 787 square feet; and the working pressure 100 pounds to the square inch. The propeller is made of manganese bronze, is 22 feet 4 inches in diameter, with a pitch of 31 feet. The maximum number of revolutions at the trial was 66½ per minute, accompanied, the *Engineer* says, by absolutely no vibration, except in the immediate vicinity of the screw shaft. The hull is built of steel, on plans approved by the Admiralty, with a view to national requirements, and is capable of carrying coal for a twenty days' cruise.

The Stirling Castle is intended for the tea trade. In view of her performance the recommendation of our board of naval advisers to build "fast" cruisers having a maximum speed of 15 knots would seem to be a trifle out of season. Twenty-five knots should be the figure aimed at.

A Foolhardy Project.

Captain Fred. Norman, who crossed and recrossed the Atlantic with George Thomas in the Little Western (16½ feet long by 6½ feet wide), now proposes to row across the Atlantic alone. He says he will use a boat built under his own supervision, about 12 feet long by 4 feet wide, and from 2 to 2½ feet deep, partly covered fore and aft. He will take a floating sea anchor to keep the boat's head to the wind while he sleeps. He will have no fire but a lamp, and will use prepared food, condensed coffee, and carry about fifty gallons of water. He thinks he could make the voyage in 100 days.

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UNIFORMITY IN CHEMICAL NOMENCLATURE.

We possess authority for the statement that a rose would smell as sweet by any other name, and we have had olfactory demonstration that hydro-sulphuric acid, hydric sulphide, or sulphureted hydrogen retains its characteristic repulsiveness under all its numerous aliases. Notwithstanding that the premises are granted, it must be confessed that too many names for one substance are objectionable. Chemists have long recognized the fact, and while they have no desire (or power) to change the old familiar terms used in trade and in the arts, such as bluestone, aquafortis, and vitriol, they are making a vigorous effort to establish uniformity in scientific nomenclature. A convenient basis for such a change is offered in the circular recently issued by the editor of the *Journal of the London Chemical Society*, containing "Instructions to Abstractors." The nomenclature here advocated is employed in the new supplement to "Watts' Dictionary of Chemistry." As both of these works are widely read and acknowledged as authority on scientific matters, whatever nomenclature is adopted therein must soon become familiar to most English-speaking chemists, and ought to come into use sooner or later in their writings.

Some of the rules laid down in the circular seem rather arbitrary, and many familiar names give place to those that are new or unfamiliar. Without, however, stopping to criticise, we will proceed to describe some of the most important points.

In naming salts, use the name of the metal followed by an adjective representing the acid or negative radical: sodium chloride, potassium sulphate, ferrous sulphate, mercuric chloride. The terminals *ous* and *ic* are used only when there are two salts of the same metal, differing only in degree.

When a metal or alcoholic radical unites with hydroxyl (OH) the compound is called a *hydroxide* instead of a hydrate; thus, potassium hydroxide for caustic potash, or potassa, KOH; and phenyl hydroxide for carbolic acid, $C_6H_5(OH)$. The name hydrate is reserved for compounds supposed to contain water of combination or crystallization.

The term *acid* is applied only to compounds of hydrogen with negative radicals, such as HNO_3, H_2SO_4, H_3PO_4. Oxides which replace acids are called *anhydrides* as before.

Salts in which all the hydrogen of the acid is displaced by the metal are called *normal* instead of neutral salts. The old bisulphate or acid sulphate of soda becomes hydrogen sodium sulphate.

The principle of naming hydrocarbons is best shown by a few examples; thus, CH_4 is methane; C_2H_6, ethane, etc.; C_2H_4 is, as before, ethylene; C_2H_2, acetylene; C_3H_4, allene.

All alcohols have names ending in *ol*; thus, quinol for hydroquinone, resorcinol for resorcin, glycerol for glycerin, mannitol for mannite. Words like indol that now end in *ol* have an *e* added, thus, indole. Furfurol becomes, however, furfuraldehyde. Ethers derived from phenols have names ending in *ol*.

Alcohols are to be spoken of as mono-, di-, or tri-*hydric*, instead of monobasic, etc.

Bodies such as acids of the lactic series containing the group OH should be termed *hydroxy-* and not oxy- derivatives.

The term *ether* is applied only to the oxides of hydrocarbon radicals, and the word *esther* is not used.

Compounds of the radical SO_3H are called *sulphonic* acid, or *sulpho-compounds*.

Basic substances have names ending in *ine*, as aniline, instead of anilin, the termination *in* being retained for certain neutral compounds like palmitin, albumin, etc. The compounds of basic substances with hydrogen chloride, bromide, or iodide receive names ending in *ide* and not *ate*, as morphine hydrochloride and not hydrochlorate.

For formulæ dots are employed instead of dashes; Me is used for CH_3, Et for C_2H_5, Ph for C_6H_5, etc.; and the formulæ is written *in one line* if possible. This latter point will make a large saving in the cost of composition, and be a welcome change to editors and printers.

CARELESSNESS AS A CAUSE OF FIRE.

The records of the city Fire Department for 1881 show that the commonest cause of fire was sheer carelessness. There were 1,785 fires in all, in 70 per cent of which the damage was less than $100. Eleven fires were proved to be of incendiary origin, and the causes of 168 were not discovered.

The largest item in the classification of causes was carelessness with respect to matches, smoking, lights, and hot ashes. There were 413 such fires, and nearly as many more were attributed to accidents, not necessarily through carelessness, with stoves, fires, furnaces, and grates.

Sixteen fires were traced to boys' bonfires, 81 to children playing with fire and matches, and 13 to malicious mischief on the part of children. Sixty-three fires originated in kitchens, many of them by the falling of fat meats and the like into the fire. Ten cases are attributed to contact of clothing with stoves. Defective flues, fireplaces, chimneys, stovepipes, and grates caused 62 fires; beams built in flues, 14; overheated stoves and pipes, 41; foul chimneys, 186; falling soot, 41; coals from stoves and grates, 18. Six fires were caused by overturned or leaky kerosene stoves, and 127 by accidents to kerosene lamps. Fires from gas were fewer: 28 from escaping gas; 3 from explosion of gas; one gas meter exploded, and one gas stove was upset, causing fire. Still fewer were the fires charged to electricity, only 4 being attributed to this agent. One of these fires, which occurred in the Germania Theater building, was in its origin decidedly

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peculiar. According to the Fire Marshal's explanation the insulation of a wire that ran over the tinned arch over the Thirteenth street door was defective, and water that fell around the wire during a rain led the electric current from it to the tin. It melted the solder, burned the tin, and ignited the woodwork under the tin.

There were 24 fires caused by fireworks, the number from this cause diminishing year by year. Window curtains, goods in shop windows, Christmas trees, clothing, drapery, and woodwork were ignited by gas jets, lamps, and candles in 99 instances. In the opinion of the Fire Marshal the placing of gas jets near window frames should be prohibited.

The total estimated fire loss for 1881 on buildings and vessels was $726,291, and on stock, $5,093,968. The estimated insurance loss on buildings and vessels was $54,893; on stock, $1,062,514. Total, $1,117,401. There were two fires with a loss each of from $50,000 to $60,000; one of from $60,000 to $70,000; one of from $70,000 to $80,000; two of from $150,000 to $200,000; one of from $262,000 to $350,000; one of $1,025,800; and one of $2,302,691.

Of the 1,785 fires 1,552 were confined to points of starting; 109 to the building itself; 33 extended to other buildings; 17 were on vessels; and 74 were in woods and such places.

TESTING CHOCOLATE.

In a lecture delivered before the chocolate manufacturers of Cassel, E. Herbst said that, although the adulteration of food is nearly as old as its preparation, yet it had made greater progress in recent times owing to the progress attained in the development of chemical methods. Fortunately the progress of chemistry aids those engaged in detecting and exposing these adulterations equally with those engaged in the opposite pursuit. The more deceptive the methods employed in adulterating the more complete and certain are the methods employed in detecting and exposing them.

It is easy to see that the necessary certainty and clearness has not yet been attained in all cases, since the art of testing food by scientific methods is scarcely more than fifty years old, and because we rarely have to do with simple chemical substances, but mostly with mixtures very difficult to separate. Certainly chemistry should not be blamed for such flaws in its methods, for every science has similar imperfections, but the representatives of those sciences should know these flaws so as to know just how far their methods are reliable and to what degree these reactions are conclusive.

That these self-criticisms are not sufficiently practical by all chemists has frequently been proven by experience. Within the last decade, since the chemical examination of human food has received special attention, we have seen how often the most incredible analytical results used for the judicial prosecution of dealers and producers, and the exaggerated statements which have been made regarding the extent of food adulterations, have excited in the public a mistrust and suspicion which, with the single exception, perhaps, of wine adulteration, is out of all proportion to the actual frequency. One case may here be adduced as proof of what has just been said. Some time since twenty samples of chocolate were tested in Stettin, and declared adulterated, and the manufacturers indicted. Upon an appeal of the indicted persons, the chocolates were again examined, and in the second instance were all pronounced pure and unadulterated.

Unpleasant occurrences of this sort have produced a lamentable sense of insecurity among producers as well as consumers, and a justifiable mistrust of the reliability of chemical tests. They form a welcome tool for the manufacturers with which to combat the enforcement of the food and victuals law. The honest manufacturers oppose the law because they have reason to fear injury to their good name and credit, as well as to their pockets, from careless tests of their goods; while the dishonest parties prefer to conduct their adulterations without any law to fear.

This *explains*, but does not *justify*, the opposition of manufacturers to the law. The honest manufacturer is as much interested as the chemist in deciding just what is deceit and adulteration, and what is allowable.

The lecturer had had occasion to test forty kinds of chocolate in the experimental station at Carlsruhe. He determined the quantity of water, fat, sugar, of dried cacao mass, and of ashes, in all these chocolates. He also tested the purity of the fat, and examined the chocolate microscopically.

The determination of the water by drying a weighed quantity of chocolate at 60° or 80° C. offers no difficulty; to render the mass more porous it is mixed with twice its weight of dry sand. The fat was extracted with ether from 10 grammes of chocolate in Soxhlet's extraction apparatus, and dried at 100° C. before weighing. It was found that the same chocolate, treated in the same apparatus, gave ½ to 1 per cent more fat in the first analysis than in the second; and that in the first analysis the ethereal solution of fat was turbid, but in the second it was clear. The cause of this was found to be that the ether extracted a resinous substance from the new cork stopper the first time it was used, and this contaminated the fat and caused turbidity; hence it is advisable to boil the corks in ether several times before using. The ethereal fat solution had also, almost always, some brown flakes, which were shown by the microscope to be cacao substance, hence it was necessary to filter the solution before evaporating it. The purity of the fat, after drying and weighing, was tested by aid of its melting point and solubility in ether; its odor is not of much use, as it is concealed by the characteristic cacao aroma which adheres to it very tenaciously. The fusing point of cacao fat determined in capillary tubes is not, as frequently stated, between 27° and 31° C., but remains quite constant at 21° C. (70° Fahr.). Since tallow melts under like conditions at 34° to 37° C., any considerable adulteration could easily be detected by the melting point. It would be still more distinctly seen by the so-called ether test. Cacao fat dissolves completely and easily in twice its weight of ether, while tallow requires much more ether for solution, so that when tallow is present a turbid white paste is formed instead of a perfect solution of light yellow color.

Although it is not difficult to detect tallow, many chemists have racked their brains in vain in seeking a test for sesame oil; but really it is scarcely worth the trouble, for experience has shown that it is impossible to put more than four per cent of sesame oil in chocolate without its striking through the paper wrappers; or, if tin foil is used, the chocolate has a greasy and suspicious appearance. The addition of so small an amount of a nutritious substance like sesame oil is not calculated to greatly enrich the manufacturers, and is scarcely added for pecuniary reasons, but rather to give it a smoother and finer appearance, especially on the fracture.

The sugar is determined in the chocolate from which the fat has been extracted by ether. It requires some attention and experience to obtain figures not entirely unreliable. Herbst employs the extraction with alcohol as the handiest and best. The chocolate mass is wrapped in filter paper and boiled in fifty per cent alcohol as long as it imparts to it a reddish brown color. It is not advisable to employ water alone to dissolve the sugar, as that dissolves the cacao starch, and the result would be much too high, especially when there is flour in it.

By evaporating this extract to dryness and weighing the residue, figures are obtained that may be six per cent too high, because the alcohol dissolves other extracting substances present in chocolate. It is, therefore, necessary to dissolve the residue in cold water, filter, evaporate again, and dry at 100° C. in a stream of coal gas.

One circumstance deserves notice here, that may cause the manufacturer and analyst to differ. In most cases a chemical analysis shows a rather higher percentage of sugar than the proportions used in making it. One reason for this is that in making chocolate the substances are weighed in a moist condition corresponding to the moisture in the atmosphere, and are afterwards dried, so that the percentage composition, when finished, differs from that of the recipe. Then, too, a small part of the starch in it may easily be converted into sugar. As yet Herbst never has found the amount of sugar to differ more than two per cent from that required by the recipe.

The mass from which fat and sugar have been removed is dried and weighed. The sum of water, fat, sugar, and residue must equal 100. [He seems not to take into account the extractive matter dissolved by alcohol.—ED.]

As pure cacao contains, on an average, fifty per cent of fat, the quantity of fat found in manufactured chocolate ought to be about equal to one-half the weight of the chocolate after deducting the sugar. For example, chocolate made from 63 parts of sugar and 37 of cacao mass would normally give about the following results:

Moisture	2 per cent.
Fat	17 "
Residue	18 "
Sugar	63 "
	100

If this chocolate contained much more or less than 100—63÷2 per cent of fat, we should suspect adulteration, and carefully test the extracted fat.

The percentage of ash in normal chocolate should not much exceed two per cent. It may, of course, be tested for mineral substances, like ocher, bolus, and barytes, which are added sometimes to give weight or color.

Microscopic examination serves to detect flour, sago, chiccory, acorns, etc.

From the results of the above-given tests it is not difficult for a chemist to judge of the value of a sample of chocolate and to detect gross adulterations worthy of punishment.

In constructing a law to regulate and prevent the sale of adulterated chocolate, the above facts must be taken into account, and then the legal definition of chocolate would be nearly as follows: "Chocolate is a mixture of nearly equal parts of sugar and ground cacao mass, with the addition of certain flavors and spices, but excluding all foreign fats and grease.

An addition of flour can only be permitted when the kind of flour is plainly stated on the label." This would work no injustice to manufacturers, while it would indicate to the chemist what to direct his attention to, and would benefit producers and consumers equally.

As regards the chemist himself, if he is unable to recognize the foreign fats with sufficient sharpness, he will be aware of the flaws in his own knowledge and keep silent until he has filled up the gap, or until he has found a reliable test for the purity of cacao butter. In this, as in every other case of the chemical examination of food, much injury is done by chemists who claim to be able to do the (at present) impossible, and make their reports too sweeping. It were better to confess ignorance than to try to palm off an ingenious guess for a scientific analysis.

The Secret of the Keely Motor.

Some weeks ago the Keely Motor Company brought suit against Mr. Keely to make him keep his promises and take out patents.

It was charged by the company, who, it is said, have put $150,000 into his schemes, that he agreed to apply for letters patent by July of last year. The company's attorneys, it was arranged, should superintend the preparation of the necessary papers, and they were to tell the secret to no one. When July came Keely asked until November to put the finishing touches to his inventions. This was granted, but it resulted in nothing, and the shareholders were obliged to resort to the law to force Keely to keep his contract. Keely's defense was purely technical. Joshua Pusey, who represented him, argued that the inventor could not be made to expose that which was hidden in his own brain. If he were directed to divulge his secret, who could say whether what he might say would be a secret or not? The court could not make a decree, he said, because there were no reasonable means of enforcing it.

Nevertheless, after hearing the argument at length, Judge Pierce, of the Court of Common Pleas, Philadelphia, overruled Keely's demurrer, and ordered him to make known his process according to his contract with the company. The court, no doubt, treated the suit with becoming seriousness, but it is suggestive, to say the least, to see that the order was given April 1.

A Manometer for High Pressures.

To avoid the use of very long and cumbersome mercury tubes, Dr. M. Thiessen, in Berlin, has invented one consisting of several short tubes. These are arranged vertically and terminate at both ends in a larger steel tube provided with stopcocks, so that the tubes can be cut off from each other in pairs, so that Nos. 1 and 2 are united at the top, 2 and 3 at the bottom, 3 and 4 at the top, 4 and 5 at the bottom, etc. The apparatus is first filled with water, avoiding air bubbles, and then part of the water is displaced with pure mercury, so that when all the cocks are opened each tube will be half full of mercury. The tubes are then shut off from each other in pairs as above described, connecting alternately above and below. When pressure is exerted on the water in the first tube, the mercury will rise to about the same height in every tube, but the pressure exerted will nearly equal the pressure represented by the sum of the differences of levels of the mercury in each tube. For greater accuracy in arriving at results for scientific purposes the columns of water must be reduced to mercury pressure and each tube corrected by previous experiment. By making use of a suitable comparator for measuring difference of height it is said that very accurate results can be obtained.

P. N.

The Kingship of Cotton.

Whoever controls the cotton goods of the world controls the exchanges of the world. In this sense, "Cotton is king." The great mistake of the Southern people, in thinking that cotton was king, consisted in believing that raw cotton was king. There was a little of truth in their belief, as there is in most wide-spread popular delusions. Whoever controls the cotton cloth is a king, and powerful though not an unlimited monarch. Very few people want raw cotton; or can do anything with it, individually; every one wants cotton cloth, in some form, and every one can individually turn it to his purpose. The Southern people did not see this truth, and therefore never perceived that they were more completely dependent on the *manufacturer* of cotton than almost are the raisers of any other agricultural product whatever upon the consumer of that particular article. Of all the great products of agriculture, cotton in its raw state is one of the least necessity to the individual man. It requires the capital, skill, and mechanic arts to make it available.—*Senator Bayard.*

Dangerous Car Couplings.

The needless maiming and killing of brakemen and yard men in making up railway trains has often been deplored in these columns, and the belief expressed that such unaccidental "accidents" might easily be prevented. We are glad to see that a court in Orange County, in this State, has awarded John Gottlieb, a brakeman on the Erie road, $5,000 for damages so received. Automatic couplings, or couplings safely operated from the side of the car, will be generally adopted just as soon as the courts make the present style unprofitable to the railroad companies.

Large Arrival of Immigrants.

Thursday, April 6, was a busy day at Castle Garden, New York. There were landed that day 6,481 immigrants, the largest number received at this port on any day this season. All were in good health, and there is every reason to expect that the great majority of them were desirable additions to our working force as a nation. The next day the arrivals were sufficient to swell the number to nearly 10,000. Last year there were two successive days in which the arrivals exceeded 11,000.

Inventions Needed.

A writer on cranberry culture, in the *Rural New Yorker*, says that there is much needed a machine for separating the rotten and frozen cranberries from the sound in preparing them for the market. A machine of this kind that will do perfect work is not known. A machine for harvesting the berries is also greatly needed.

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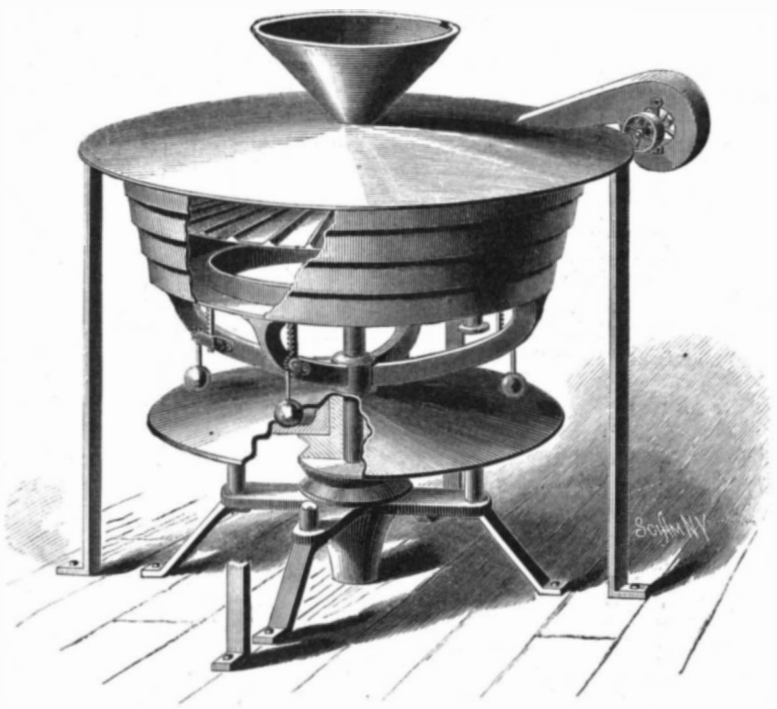
NEW GOLD SEPARATOR.

The rotary shell of the gold separator shown in the engraving is made with annular offsets upon its inner surface to facilitate the support of the mercury upon the inner surface of the shell. The base flange of the shell is provided with a movable rim, having racks and pinions for raising and lowering it, so that the height of the rim may be graduated to the amount of mercury on the flange; this rim is lowered automatically by means of the weighted arms thrown out by centrifugal force, which also causes the mercury to pass up the inner surface of the shell. The vertical drive shaft is provided with a pulley, and carries the distributer on its upper end. In using the separator mercury is placed in the ring trough at the bottom of the outer shell, and as the shell is revolved the mercury is driven up its inner surface by centrifugal force, the ascent of the mercury being facilitated by the offsets of the outer shell, the mercury being supported by centrifugal force, the flare of the shell, and the off-sets or steps. As the sand is introduced into the machine by the fan blower it falls upon the conical grooved distributing plate; it is evenly distributed by centrifugal force against the coating of mercury spread over the inner surface of the outer shell, and the particles of gold in the sand will be taken up or amalgamated by the mercury, while the sand slides down the inner surface of the outer shell and over the upper edge of the movable rim. As the sand falls from this rim it is received upon the conical discharge plate below, and is thrown out of the machine by centrifugal force. It is claimed that by this construction every particle of gold will be withdrawn from the sand and held by the mercury, while the sand is discharged freely from the machine.

This invention has been patented by Mr. Horace E. Henwood, of Kansas City, Mo.



HENWOOD'S GOLD SEPARATOR.

This useful invention has been patented by Messrs. J. Austin and R. Chamberlain, of East Liberty, Ohio.

New Disinfectant.

Professor Carlo Pavesi, of Italy, proposes as an improved disinfectant a solution composed of chloride of lime, camphor, and glycerine. This mixture is capable of being used in all cases in which phenic acid is now employed, and its odor is less disagreeable, less irritating, and less toxic than that of the latter. It is said to at once arrest the putrefaction of animal bodies, and is highly commended by the *London Medical Record*.

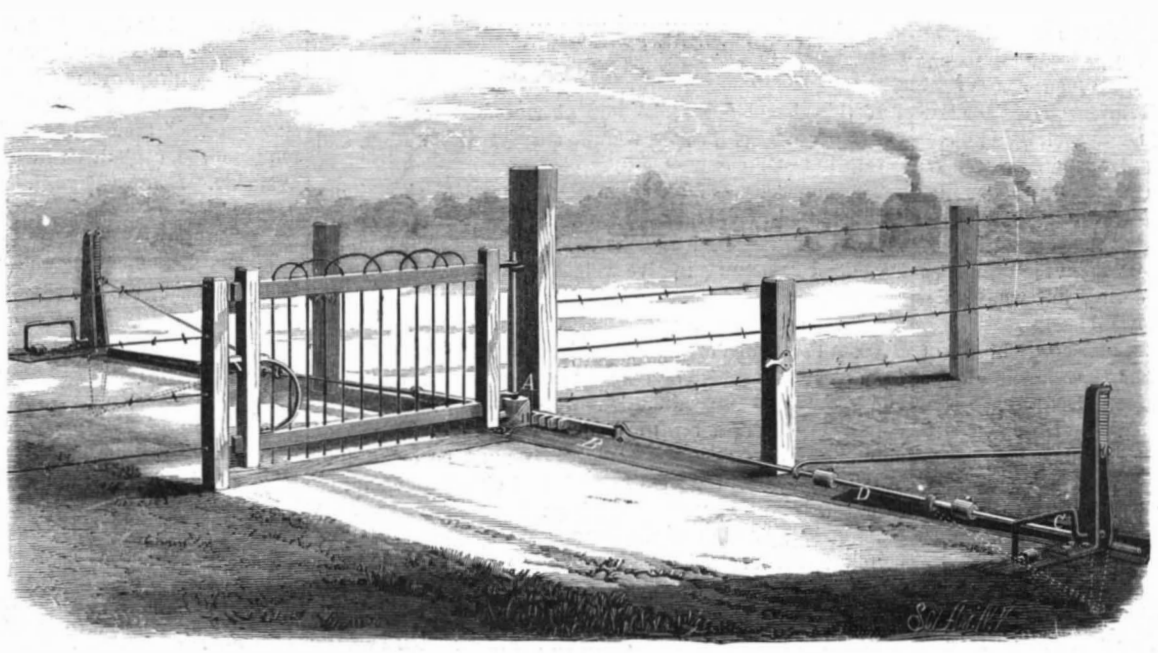
IMPROVED AUTOMATIC GATE.

This gate is opened and closed by the vehicle which passes through it without compelling the driver to alight. It is an improvement upon the form of automatic gate in which a sliding toothed bar acts upon a set of segmental teeth connected with the gate post to open or close the gate by the longitudinal movement of the sliding bar, the latter being actuated by rods on opposite sides of the gate connected with double-cranked shafts that are struck and deflected by the vehicle wheels.

To each end of the sliding toothed bar, B, is attached a horizontal rod, D, which is arranged in guides on the bed frame so as to have a free longitudinal movement. These rods extend at right angles to the closed position of the gate. Near the ends of these rods, on each side, is arranged a crank shaft, C, whose looped or cranked portion is normally held in a vertical position, so as to be struck and turned down by a vehicle wheel. On the other end of this crank shaft (on each side of the gate) is rigidly secured a lever, which is fastened about its middle to the shaft, and which lever, together with the bend of the crank shaft, is held in vertical position by a spiral spring attached to the top of the lever at one end and to the top of a vertical bar at the other. This spring will be housed in a suitable case or tubing. From the opposite ends of each lever pull rods extend, both terminating in their ends next to the gate in eyes that loosely encircle the main rod, D.

On the main rods, D, are stop blocks, against one of which the upper pull rod pulls when the crank shaft is deflected in one direction. When the crank shaft is deflected in the other direction the lower pull rod is operative. In operating the gate automatically by the passage of the vehicle, it will be seen that when the wheels of the vehicle strike the first crank shaft and deflect it toward the gate the lower pull rod pulls on the stop block, and the toothed bar is pulled toward the vehicle, turning the toothed wheel which carries a cam in which a roller attached to the gate rests. This raises the gate bodily until the latch is released, when the roller rolls down the incline of the cam, and the gate is opened by its own gravity. Closing the gate is simply the reverse of this operation. The gate operates in the same way when approached from either direction, and it may be opened by hand whenever necessary.

It will be seen that as all of the strain on the toothed bar is a pulling strain the rods may be made very small, like wires, or even chains or other flexible connections might be used.



NEW AUTOMATIC GATE.

Lightning Rods.

A meeting was recently held at the rooms of the Meteorological Society, London, at which delegates were present from the Royal Institute of British Architects, the Physical Society, and the Society of Telegraph Engineers, to consider the desirability of issuing a code of rules for the erection of lightning conductors. After discussion, a set of rules was promulgated, in which it is set forth that "the rod should not be bent abruptly around sharp corners, and in no case should the length of the rod between the points be more than one and a half times as long as a straight line joining them. Where a string course or other projecting stonework will permit, the rod may be carried through instead of around the projection." In keeping with this, "the rod is not to be kept from the building by glass or other insulators, but attached to it by metal fastenings. Rods should, preferentially, be taken down the side of the building which is most exposed to rain. They should be held firmly, but the holdfasts should allow for contraction and expansion."

This non-insistance on insulation, as to lightning rods, is to many persons strange, as adequate insulation is required for the safe use of electric-light wires. Lightning will always follow directly the best—not necessarily the shortest—conductor, in its passage to or from the earth; to use a figurative expression, it may be said *not to have time* to turn off at right-angles from a metal rod, properly joined and continuous, to enter a building. While, however, the lightning flashes instantaneously through the rod, and the quicker it passes the better, the electricity passes as a steady, constant stream to the carbons of lamps, and thence to the earth. There may be said to be a kind of "storage" of it in the wires, through its being allowed to pass only as it can inflame the carbon points of the arc light, or render incandescent the slender carbon thread. In the case of the rod, insulation as a resistant is to be first considered; in the case of the wire, insulation as a non-conductivity is the chief point.

NEW INVENTIONS.

A novel thill coupling has been patented by Mr. Elias Hoxie, of Red Creek, N. Y. This invention consists of an adjustable brace, secured to the under side of the thill and to the bolt by which the coupling is accomplished, the object being to prevent noise by the rattling of the parts against each other.

It is desirable that the covers of jars of pickle casters and analogous articles of table ware shall be permanently connected with the caster, so that they may not become misplaced or lost and yet be capable of being removed from and replaced on the jars quickly and conveniently. Mr. Thomas Leach, of Taunton, Mass., has devised an improvement in which the cover is attached to a curved or crank rod, that is adapted to slide vertically in a tubular guide forming a fixed portion of the frame of the caster and located above the jars.

Mr. James F. Edwards, of Washington, D. C., has patented an angle brick for bay windows and other obtuse-angled structures, in which the bricks at the angle shall be substantially tied with lap joints, and in which all cutting of brick is avoided, while the angle may be changed as desired.

A novel barber's paper clip has been patented by Mr. Moses Cohen, of Hallettsville, Texas. This invention relates to clips for holding slips of paper upon which razors are to be wiped in shaving the beard. It is formed by doubling upon itself a strip of metal, preferably spring brass, in such a manner that the central bent portion shall serve as a spring to hold the two straight portions in contact with each other.

Mr. Lloyd W. Gates, of Calhoun, Ky., has patented an improved car coupling the principal features of which consist of a concentric coupling hook, which is adapted to engage with a link automatically.

An improvement in hydraulic elevators has been patented by Mr. Charles T. Widstrand, of Minneapolis, Minn. This invention consists in an elevator provided with a hydraulic rotary engine, pressure wheel, or pump having an inlet pipe leading to one side of the pistons and an outlet pipe leading from the opposite side, a reservoir communicating with the outlet pipe, and an induction valve located between the pipes, and which is adapted to connect them with each other, so that the cylinder may be kept full of water, and the descent of the cab regulated by the free or retarded circulation of the water through the port of the induction valve.

Mr. Thomas N. Lupton, of Winchester, Va., has patented an improvement in shutter workers for moving and locking an outside shutter from inside the sash. The shutter is operated by a horizontal bar extending through the side facing of the window, and connected with a lever which moves above a toothed sector into which it locks to secure the shutter in the required position.

Mr. John G. Trenear, of Huntington, W. Va., has patented an improved mode of ventilating sewers and traps by which all gas will be removed from the sewer by passing through a vertical pipe into an air pipe, and thence to a furnace, where the gas is consumed. If any gas passes up through the lower end of the waste pipe, it will pass thence through another pipe into the air pipe and be carried thence to the furnace and consumed.

A novel agitator or egg beater has been patented by Mr. Gus. W. Richardson, of Hill Grove, Ky. This is an ingenious arrangement of a hollow cover apertured on its sides and inclosing a set of agitating wheels, by which the eggs are rapidly and thoroughly beaten.

Mr. George F. Goodell, of Fulton, Ill., has patented a calendar adapted for continuous use for indicating days and months, and also for finding the day of the week and months of years past, present, and future. This invention consists in the combination of changeable week and month rollers and a calendar card having upon it a monthly calendar and a key calendar for use in setting the rollers.

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Magnetic Iron Ore Sands in the Forge Fire.

In a paper read before the U. S. Association of Charcoal Iron Workers, at Ironton, October 12, 1881, Mr. M. Hoagland, of Rockaway, N.J., gives the following interesting facts.

At the Rockaway Rolling Mill, in New Jersey, four Catalan forge fires are in operation, making charcoal blooms from black magnetic sand, and a very superior article is produced for steel purposes. The product is largely used by the Sanderson Brothers Steel Company, at Syracuse, N. Y., and it is found that crucible steel made from this mineral sand is superior to anything yet produced from any other American iron; in fact, equal in every respect to steel made from the best brands of Swedish iron. The steel made from this sand has been thoroughly tested for cold chisels, turning tools, and miners' drills, and in every instance has given entire satisfaction. The ore is treated by the Wilson process of deoxidizing, and afterward worked in the usual way in the Catalan forge. The deoxidizing, it is claimed, saves one half the charcoal, or, in other words, it takes only one half as much coal to make a ton of iron by the Wilson process as is used in the old-fashioned fires. The waste heat from the fire is used for deoxidizing the ore. It was found difficult to work this black sand, on account of the large percentage of titanic acid it contains, until they adopted a method of clearing it with a powerful magnetic machine invented by C. G. Buchanan, and manufactured by M. H. Hoagland, of the Union Foundry. The machine separates the magnetic sand so thoroughly that none of the titanium is found in the portion which passes over the magnet; in fact, where properly managed, the product of the machine will yield by analysis 71 to 72 per cent of metallic iron.

The results of the separation have been so satisfactory that parties who have other ores than black sand have adopted machinery invented by Mr. Buchanan to reduce their ores to a fine consistency, separating by the magnet, preferring the magnetic process, because the fine ore which is washed away by the jigging process is all saved, the magnet taking out nearly all the ore, leaving less than two per cent in the tailings. Another set of this machinery is to be put in operation as soon as it can be built, at Elizabethport, N. J., where the Wilson process will be used, producing iron by the direct method, using petroleum as fuel in puddling furnaces.

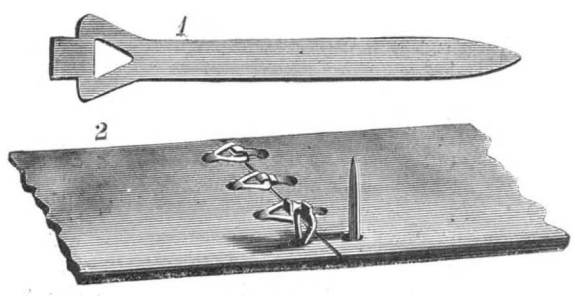
Printing Ink.

The base of our common printing ink, as is well known, is a linseed oil varnish, which sometimes possesses a disagreeable odor, and the ink made from it smells so badly as to make a freshly-printed paper an unpleasant companion for sensitive nostrils. Dr. Brackenbusch, of Berlin, proposes to overcome this disadvantage by replacing the linseed varnish with a solution of colophonium (rosin) in paraffine oil. He dissolves 45 parts of fine rosin in 25 parts of paraffine oil by heating them to 80° C. (176° Fah.) or by mixing them with a machine at ordinary temperature. When the solution is effected, if such it may be called, 15 parts of soot or lampblack are added.

NOVEL BELT FASTENER.

The engraving shows a simple, easily applied belt fastener, recently patented by Mr. Alfred H. Noble, of New Milford, Conn. The fastener is cut from a sheet of brass, as shown in Fig. 1, and has an open head or eye, a tongue or shank projecting therefrom and capable of being inserted through holes in the meeting ends of a belt and through the head or eye, and folded over. A lip projecting from the head or eye opposite the tongue is folded over the tongue to hold it down. The form of the fastener is shown in Fig. 1. The various steps in the operation of fastening the belt are shown in Fig. 2.

The first fastener is shown as merely inserted in the holes in the adjoining ends of the belt. In the second fastener the tongue is drawn through its hole in the head of the fastener, and is bent upward at right angles and cut off at the required length. In the third fastener the tongue is bent



NOBLE'S BELT FASTENER

down on the lip projecting from the head, and in the fourth the lip is bent over the end of the tongue.

This fastener, besides being simple and easily and quickly applied, is cheap and strong, having all of the advantages of the best leather lacing with none of its defects.

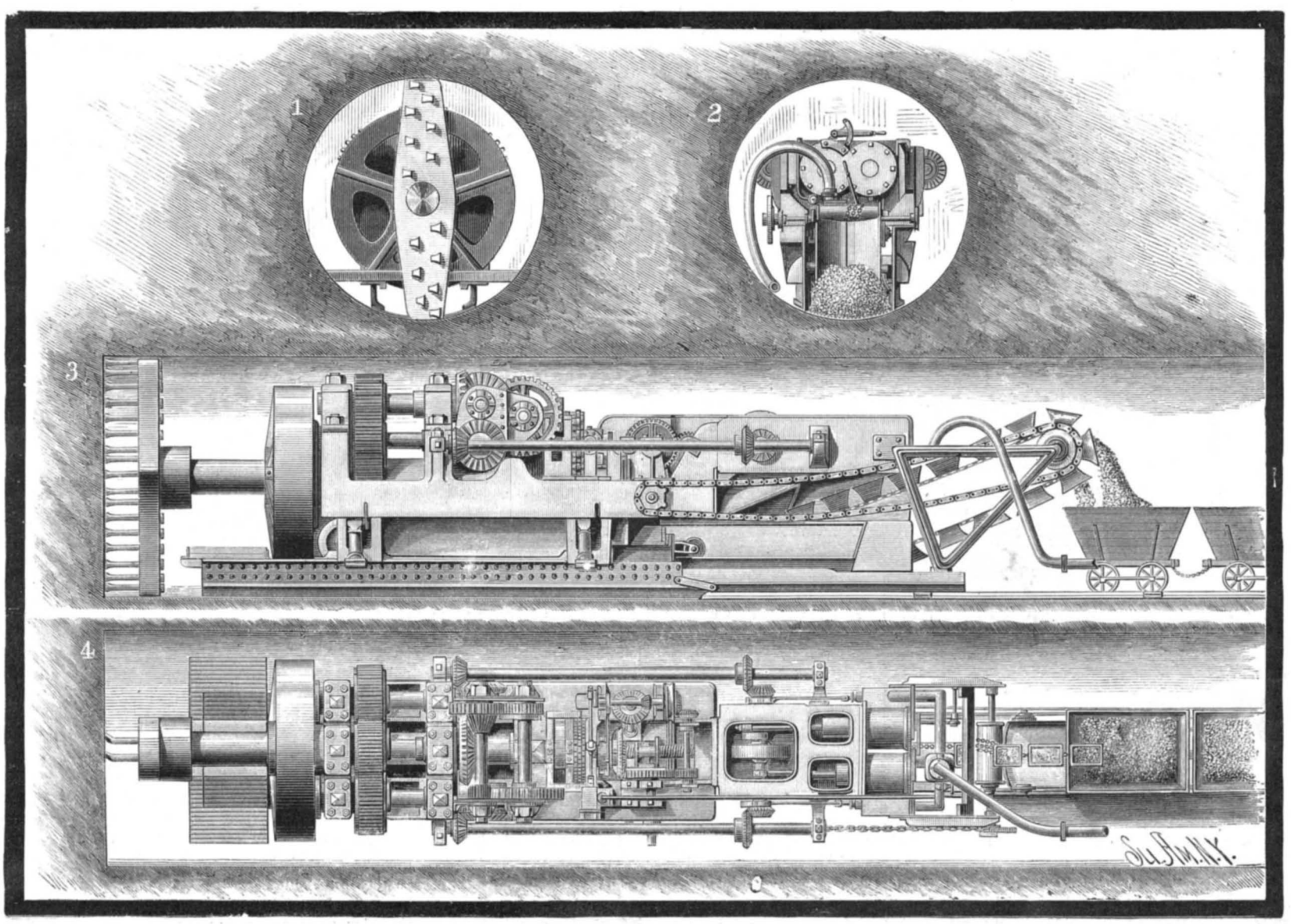
Further particulars may be obtained by addressing the inventor, or Messrs. Greene, Tweed & Co., 118 Chambers street, New York city.

COMPRESSED-AIR MACHINE USED IN THE CHANNEL TUNNEL.

The length of the Submarine Continental Railway Company's Tunnel, under sea, from the English to the French shore, will be twenty-two miles; and, taking the shore approaches at four miles on each side, there will be a total length of thirty miles of tunneling. The approach tunnel descends from the daylight surface by an inclosed gallery, with an incline of 1 in 80, toward Dover, to a point on the Southern Railway Company's line, about two miles and a half from Folkestone. The exact point is at the western end of the Abbot's Cliff tunnel, at which point the gault clay outcrops to the sea level. Half a mile of heading has been driven, by machinery, from this point; after which the works were suspended to enable them to be resumed at a point nearer to Shakespeare's Cliff, where the tunnel passes under the sea. The shaft at this point is 160 feet deep. It is sunk close to the western end of Shakespeare's Cliff. The shaft passes through about 40 feet of overlying *débris;* it then just touches the white chalk, which is pervious to water, after which it goes down to the beginning of the tunnel, which is here 100 feet below the surface of the sea. A heading, now three-quarters of a mile long, has been driven in the direction of the head of the Admiralty Pier, entirely in the gray chalk, near its base, and a few feet above the impermeable strata formed by the gault clay. The idea of the projectors is so to localize the tunnel, not only in the part already made, but also when it passes out under the sea, that it shall have the body of the gray chalk above it, and that of the gault clay below it, both these strata being in themselves impervious to water, and both alike having heavily watered strata on each side of them; namely, the white chalk above the gray chalk, and the lower greensand below the gault clay. This condition, together with that of providing sufficient roof between the top of the tunnel and the sea, which roof has a thickness of 150 feet, will necessitate the tunnel being turned in a curved line.

The present heading is 7 feet in diameter. Machinery is being constructed by which this 7 foot hole can be enlarged to 14 feet, by cutting an annular space, 3 feet 6 inches wide, around it. This will be done by machinery similar to that already described, but furnished with an upper bore head, suitable for dealing with chalk, to make an annular cutting, instead of acting like the first machine, which makes the 7 foot cutting. The one machine will follow the other, at a proper interval; and the *débris* from the cutting by the first will be passed out through the second machine. The compressed air, likewise, which is necessary to work the advanced machine, will be similarly passed through the machine coming behind. There will be no difficulty in speeding the machines so that they shall work along the tunnel at the same rate of progress; and the larger machine can, as well as the smaller one, do its work with a minimum of manual labor; only two men are at present needed for each machine.

The engraving shows the Beaumont & English compressed-air boring machine at work. The length of this machine from the borer to the tail end is about 33 feet. Its work is done by the cutting action of short steel cutters fixed in two revolving arms, seven cutters in each, the upper portion of the frame in which the borer is fixed moving forward five-sixteenths of an inch with every complete revolution of the cutters. In this way a thin paring from the whole face of the chalk in front is cut away with every turn of the borer. A circular tunnel is formed having a diameter of 7 feet. A man in front shovels the crumbled *débris* into small buckets, which, traveling on an endless band, shoot the dirt into a "skip" tended by another man. The skip, when filled, is run along a tramway to the mouth of the shaft. At present these trolleys, each holding about one-third of a cubic yard, are drawn by men, but before long it is hoped that small compressed air-engines will be used for traction. The rate of progress made with the machine is about one



BEAUMONT & ENGLISH'S COMPRESSED-AIR TUNNELING MACHINE EMPLOYED IN THE CHANNEL TUNNEL.

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hundred yards per week, but will soon be much accelerated. As worked at present, the number of revolutions it makes is two or three per minute, which, as the advance by each revolution is five-sixteenths of an inch, amounts to boring nearly an inch a minute while the machine is at work. But Colonel Beaumont anticipates no difficulty in making the machine cut its way at the rate of three-eighths of an inch per revolution, and getting five revolutions per minute, which would give a rate of advance of two inches per minute. A very important question has been raised with regard to the supply of compressed air. Carried in four-inch iron pipes, it now reaches the machine with a pressure of about 20 lb., the pressure at the compressor at the shaft mouth being from 30 lb. to 35 lb.; but by increasing the diameter of the supply pipe to eight inches the loss of working value by friction would be greatly diminished, if not rendered inappreciable. The boring has now advanced to the length of 1,250 yards, or, say, three-quarters of a mile, and it is going on at the rate of three miles a year. Simultaneous borings from the French side at the same rate would give six miles a year, or a complete tunnel underneath and across the Channel in three years and a half.

The shape which the completed tunnel will assume will probably be a circle 14 feet in diameter, but flattened at the bottom to receive the rails. It will be lined with two feet thickness of cement concrete; not that this is necessary to insure the stability of the work, but to prevent accidental falls of chalk. The concrete will be made of shingle from Dungeness, and of cement formed from the gray chalk excavated from the tunnel itself. In this manner the tunnel will afford the means of its own lining at a cheap rate. The gradients will be 1 in 80, on each side, until the depth 150 feet below the bottom of the sea is reached; after which the line may be said to be level, subject only to a very slight inclination from the center outward, to prevent the lodging of water.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court—District of Maryland.

THE AMERICAN BALLAST LOG COMPANY OF NEW YORK *vs.* BARNES *et al.*

In equity—before Judges Bond and Morris.

PATENT NO. 126,938—BALLAST LOGS—PATENT.—The complainants' device is essentially a combination of two counterbalance weights, and cannot be construed to cover all methods by which vessels may be kept in an upright position while in port, by means of contrivances fastened on the outside and floating in the water, but only such as are substantially identical with the device described in a patent in construction, form, and principle of operation.

Defendant having dispensed with one of the essential elements of the combination, and having substituted therefor a new mode of accomplishing the same object, not a mechanical equivalent, and not similar in principle of operation, there is no infringement.

Bill dismissed.

Financial and other Results of the Recent International Exhibition of Electricity at Paris.

Mr. Cochery, the Minister of the Post and Telegraph Department, lately addressed a report to Mr. Grevy, President of the French Republic, giving a recapitulation of the financial results of the exhibition held last year in Paris, and this summary has just been published. Some of its most essential points will be of interest to American inventors and other participators in the Exhibition. Mr. Cochery says:

"In face of a recess of the Chamber of Deputies we were unable to engage the state in eventually paying certain sums in case of debts being incurred; at the same time it would have been impossible to wait till the assembling of the deputies before beginning the preparatory work.

"Some people having liberally offered to guarantee the state against any losses which might be entailed by the Exhibition after deducting the receipts it produced, we were enabled to accept these propositions, which protected the state against any eventuality, and were happily able to invite the different nations to take part in the Exhibition.

"The association formed for the purpose of carrying out this Exhibition, guaranteeing the state against loss, at the same time stipulated besides, that in case the receipts of the Exhibition be greater than the expense incurred the balance should be remitted to the government, to be employed by the same in works profitable to the electric light.

"The Exhibition was opened on the 10th of August, and though in the beginning all was not finished, fifteen days had not elapsed before the completeness of arrangement was perfect.

"From the 27th of August the Palais of Industry was illuminated by electric light every evening.

"The number of exhibitors was 1,764, of which 937 were Frenchmen and 827 were foreigners.

"The number of visitors who bought cards of entry was not less than 673,473. Free entry was permitted to a great many. Cards were distributed most liberally to schools, workshops, etc., and the two last days of the Exhibition were devoted to the public gratuitously. During these two days more than 80,000 people were able to profit by this liberality.

"The law of the 27th of December, 1880, accorded a subvention of 200,000 francs, and to this sum 25,000 francs were added by the city of Paris; to this add the receipts, and we find the sum total of the Exhibition's treasury to have been 1,048,417.68 francs; actual expenses, 689,490.84 francs. From this it results that a net profit of 358,926.84 francs was made, and after having settled a few debts still unpaid the remainder will not be less than 325,000 francs. It is this sum, the subvention by the state of 125,000 francs deducted, that will be returned to the government with the prayer that the same be used in creating a laboratory of experimental electricity."

Mr. Cochery then proceeds to recommend that this petition be granted, as he considers that the signature of the President affixed to a deed or decree carrying out the idea the petition designates, will be a perfect completion to favorable results attained by the Exhibition, and thus be an encouragement for those who in future undertake to carry out exhibitions.

The collection of electrical machines and implements at the Palace of Industry proved what immense progress has been made in electricity within the last few years, and the establishment of a central laboratory of electricity will furnish the means, in France at least, to develop this science, the future of which is so vast.

The laboratory will in a modest way continue the work of the Exhibition, and will be under the supervision of the Department of Post and Telegraph, the department that organized the Exhibition of Electricity. Mr. Grevy has signed the necessary decree, and has thus established the new laboratory of electricity, sanctioning the use of the net balance of 325,000 francs produced by the Exhibition to found and support this new branch of the Post and Telegraph Department.

This is the way science and art are encouraged in the Old World. People are willing to pay high taxes when the state makes some show of generosity in such public matters as appertain to science, art, and the industries. G.

Insuring the Insurance Companies.

Edward Atkinson and William B. Whiting send the following timely suggestions to the members of the Boston Manufacturers' Mutual Fire Insurance Company:

It is impossible for any man who takes an interest in the profession of mutual underwriting not to endeavor to cope with the dangers of great conflagrations, which are day by day becoming greater in our large cities, even though the factory mutual companies have no direct interest in the matter. The only drawback to the pleasure of conducting a system of insurance—the objective point of which is not merely to pay an indemnity for loss, but much more to save property from destruction by fire—is that it becomes a habit to look at every building in process of construction with a critical eye, and one is apt to lose patience in witnessing the waste of money in unsafe methods, where the simplest rules of safety would save large sums even in the cost of building. The handsome and well composed fronts of warehouses and hotels, and the apparent solidity of churches and schoolhouses, cease to give any pleasure or satisfaction, even as works of artistic design, when we know that every part of the interior is so constructed as to assure heavy damage or complete destruction if a fire happens in any part of the premises; while the surveys which we have occasionally been asked to make, with a view to preventing the destruction of insane asylums and hospitals, leave an unpleasant impression of almost criminal stupidity and ignorance in their mode of construction, and in the arrangements of the fire apparatus. Not only does the danger to property demand attention, but the danger to life compels it; and any true man would lose all self-respect who did not use what little influence he might possess, and urgently present the lessons learned from his experience, in an endeavor to prevent disasters which may occur at any moment—such disasters as have lately occurred at the destruction of the theater in Vienna, at the recent fire in New York, and in other recent instances which need not be mentioned.

Destructive fires in theaters almost invariably begin amidst the combustible materials upon and over the stage; the scenery is not only of necessity combustible, but the materials which are in constant use, such as paints, oils, light wood, canvas, and also the processes of use, of renewal, and of repair, are all of a nature which the mutual underwriter would regard with the utmost distrust, and would only insure at all when every available means of precaution have been taken for extinguishing the fires which experience has absolutely proved will occur at comparatively short intervals in such stock, either from accident from without or spontaneous combustion within the mass. We believe this danger may be guarded against with almost absolute certainty by placing automatic sprinklers over and around the stage of any theater, and we hope we may have so impressed the Police Commissioners of Boston with the probable efficacy of this apparatus as to cause them to make its use compulsory under the authority recently given them.

But inasmuch as every member of this company has a money interest in the safety of the commercial districts of Boston, New York, and Philadelphia, no apology is needed for again enforcing the necessity of more adequate means of preventing loss, especially in New York. A computation has recently been made that in one small section, comprising an area little, if any, over two acres, there is seventy million dollars' worth of property at risk; this may be an exaggerated estimate, but there are many acres upon each of which five to ten million dollars' worth of property is at risk. During the daytime there is no head of water immediately available in this district, and the multiplication of wires is daily rendering it more difficult to raise ladders at the right places; this again causes great delay in carrying up lines of hose and in getting the water upon the fire in such a way as to do any good.

In view of these facts, attention may again be called to the entire feasibility of attaching permanent 4-inch iron pipes to the corners of blocks, and carrying a 4-inch iron pipe service with hydrants at every party-wall over the whole area of the roofs constituting a square or block of buildings; such apparatus to form a part of the public fire service, and to be used by the public fire department only, couplings being attached to the base of the vertical pipes by which a connection may be made with the steam fire engines. It may be useless to repeat this suggestion, but in view of the accumulation of wires, and the possible new dangers from electric light wires, a quick supply of water upon the roofs of our high buildings is becoming more and more necessary. At the time this suggestion was first made such a roof hydrant service, with the necessary vertical pipes, could have been put up, ready for use, at a cost of $1,600 to $2,000 an acre; it might now cost a little more.

If there are acres upon which the insurable value of the property ranges from five to thirty-five million dollars, then a sum ranging from $25,000 to $250,000 a year is paid out in premiums of insurance upon each of such acres, and if from one to ten such acres were burned, then from ten to fifty per cent of the indemnity promised under these policies of insurance would not be collected; witness the value of similar policies after the fires in Chicago and Boston. It may well be asked if it would not be worth two or three thousand dollars an acre for a service of roof pipes and hydrants, for the mere purpose of *insuring* the *insurance companies*, which may otherwise be made bankrupt by a fire covering only a small part of either of the great commercial districts of the cities named.

It may also be a matter of interest to observe the fact that if there are acres in the crowded part of the dry goods district of New York upon which a sum even approximating $250,000 is annually paid for insurance, a single year's premium might suffice to pay the cost of a pumping station on one of the docks, and of a special main pipe leading to that specific acre only.

The first answer to these suggestions always is, that no concessions can be had in the rates of insurance now charged if these precautions are adopted; to which it may be answered that no concessions ought to be made upon rates which are already so low as to preclude the accumulation of any adequate reserve, and which are depleted from 30 to over 50 per cent by the mere expense of conducting the competitive system of insurance as now practiced. But the more complete reply is this: that the man who accepts or rejects provisions for the safety of the premises in which he has a money interest, merely on the single issue of the rate of premium charged, is not a safe man to be insured at any price. The difficulty, which really lies in the way of adequate measures for protecting the concentrated hazards of cities, is in the difficulty of promoting co-operation among owners. City governments, as now constituted, are almost unfit to do the necessary work, and individual owners seem almost incapable of making the necessary combinations. If a conflagration exceeding the Chicago and Boston fires should happen to precede a financial crisis more severe than that of 1857, if not as much prolonged as that of 1873, some action may possibly be hoped for in the protection of warehouses already built.

In the meantime it is a satisfaction to note that more attention is being given to safer methods of construction in many of the more recent buildings, while the old stock of combustible churches, hotels, schoolhouses, hospitals, and asylums is being consumed at an accelerated rate; the normal rate of destruction of previous years of one church per week, and one almshouse, insane asylum, or schoolhouse per month, having been considerably exceeded during the year 1881 in the United States. The period of combustible architecture appears to be near its end, and in another generation the masters of that art may have yielded place to the better instructed graduates of the present day.

The Telephone for Finding Springs of Water.

A new use for the micro-telephone has been devised by Count Hugo Von Eugenberg, at Castle Tratzberg, in the Tyrol, namely, for finding underground watercourses. At several different places on the declivity of a hill, he buries a number of microphones in the soil, and connects each of them with a battery and a separate telephone. In the night, when other sources of disturbances are wanting, or less noticeable, he listens at the telephones, and is enabled to detect in this manner the faintest murmur or gurgling of water within the earth to a considerable depth. The microphone plays the part of the sensitive ear of hunter or savage, who is often able to detect the presence of water in the same way.

The Pioscope—Prof. Heeren's Milk Test.

This newly invented instrument, the "pioscope," consists of a disk of black vulcanized caoutchouc, having in its middle a very flat, circular depression. A few drops of the milk in question, well mixed, are placed in the hollow and covered with the second part of the apparatus—a plate of glass painted with six shades of color radiating out from a small uncolored circular spot in the middle. The colors range from white gray, to deep bluish-gray. The layer of milk is seen through the uncolored spot in the center, and its color can thus be compared with the radiating colors, and its quality is judged according to the color with which it coincides. Thus the whitest color stands for cream, the next for very rich milk; then follow, in succession, normal, inferior, poor, and very poor.

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Correspondence.

The Great Meteor of March 9, 1882.

To the Editor of the Scientific American:

At about eleven o'clock on the night of March 9, 1882, a meteor of great size and brilliancy exploded over Kosciusco County, Indiana, in latitude 41° 20′ N., longitude 8° 50′ W. from Washington. The following account of the phenomenon is derived from the Warsaw *Republican* of March 25, 1882 (edited by Quincy A. Hossler, Esq.), and from a letter written by Albert Parker, Esq., an intelligent and trustworthy observer.

Mr. Parker was one of a party of five young men who, at the time of the explosion, were riding in an open carriage or wagon about eight miles northeast of Warsaw, the county seat of Kosciusco County. The sky was entirely covered with clouds, and snow was rapidly falling. Consequently the meteor could not be seen till it had passed below the clouds; and as the explosion took place within less than a second after its appearance no trustworthy estimate could be formed of the time of flight. The motion of the meteor was from south to north, and was accompanied by a noise resembling that of a rapidly moving train of cars. Its color was a bright red, and its apparent size nearly equal to that of the full moon. According to Mr. Parker it was nearly overhead—probably a little north of the zenith—at the time of its explosion. The report was distinctly heard at Warsaw, and excited much attention from the fact of its occurring during a heavy snowstorm. The light of the meteor "was so brilliant as to blind any person looking directly at it, and notwithstanding the storm lightened the entire vicinity as clearly as the brightest day at noon." To Mr. Parker and his companions the explosion and report were very nearly simultaneous. No aerolites, however, if any fell in the vicinity, have yet been found.

DANIEL KIRKWOOD.

Bloomington, Ind., April 10.

A Phebee Bird's Victory.

To the Editor of the Scientific American:

I have noticed communications in late issues of your journal upon the subject of two and three story birds' nests. Permit me to relate the following, which I will personally vouch for. Some years ago a phebee bird had built her nest on a small projection under a piazza of my father's house, and occupied the place for several successive years unmolested. One spring a robin took possession of it before the arrival of the rightful owner, and would not give it up. The quarrel between the birds was noted by the members of the family, but nothing more was thought about it until fall, when the peculiar shape of the nest attracted attention. Upon examination it proved to be a double nest—one built upon the other—and in the lower one was found the vandal robin, dead. The phebee bird had built another nest, completely inclosing the robin, and reared her young upon the grave of her enemy.

E. H. DAVIS.

Avon, N. Y., April 8, 1882.

RECENT INVENTIONS.

Mr. George F. Oehrl, of Belle Vernon, Pa., has patented an improved cattle car, which can be converted from a single to a double deck car, and *vice versa*, rapidly and conveniently. The cattle car is constructed with a vertically adjustable platform provided with guide rollers running in grooved vertical tracks, which platform can be raised or lowered by means of chains attached to this platform and to shafts journaled in the top of the car. When in a lowered position the platform rests on suitable fixed supports projecting from the inner sides of the car and on removable cattle guards in the doorways, and when raised is supported by pivoted L-shaped latches. The car is provided on each side with two independent gates, one above the other.

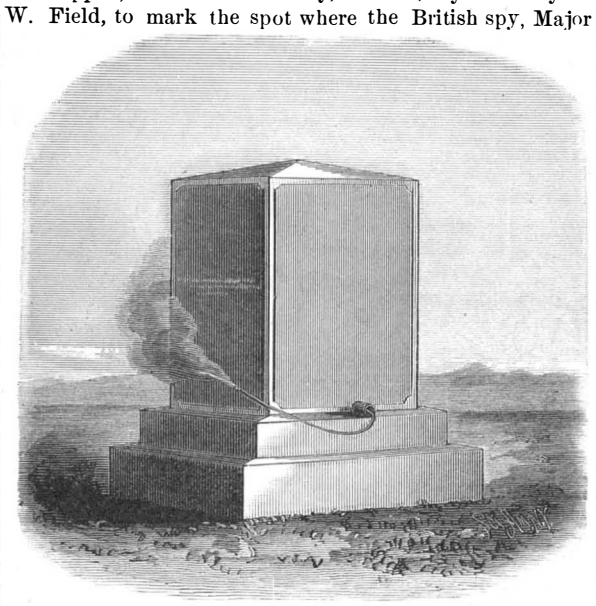
Heretofore a sheet metal plate having ornamental figures painted on its outer face, forming a screen and fitting over the mouth of a fireplace, and adapted to slide in grooves in the jambs, and raised by weights attached to cords secured to the upper end of the metal plate and passing over pulleys, has been employed as a combined fire screen and fender. In this construction, when the sheet metal plate forming the combined fire screen and fender becomes hot, the paintings are liable to be destroyed and the fender only remains, and when the fender is hot and raised it is extremely liable to set on fire the wooden mantelpiece surrounding it, and the construction above described also requires an addition to the upper part of the mantelpiece. To remedy these defects, Mr. Thomas J. Suggs, of Fort Gaines, Ga., has invented a combined fire screen and fender, which consists of two sheet metal plates sliding in grooves in the jambs, the outer one provided with ornamental figures painted on its outer face and constituting the screen, and the inner sliding plate forming the fender, with a single balance weight for each sliding plate, the fender, when lowered, protecting the screen, when down, from rain and soot falling down the chimney, and preventing the screen from been overheated and the paintings on its outer face from being destroyed.

Mr. George Gough, of Brooklyn, N. Y., has patented an improved cover attachment for jewelry cases, butter dishes, sugar boxes, bonbonnières, and other like articles, whereby the cover can be raised by pushing backward the bail handle of the case or box.

Mr. Franklin P. Athey, of Middleway, W. Va., has patented a poke to prevent horses from jumping fences. It will choke the horse and force him away from the fence when he approaches the fence and attempts to rise into position to make the leap. The invention consists of a long slotted reach pivoted to the bow which goes around the neck of the horse, in combination with a cross frame which is also pivoted to the bow and connected to the reach by a cross-piece passing loosely through the slot, the reach being formed with a rearward extension, the end of which is provided with a cross-piece or head which comes against the throat of the horse, the rear part of the frame coming against the breast of the horse.

THE ATTEMPT TO DESTROY THE ANDRE MONUMENT.

A year or so ago a small monument of granite was set up at Tappan, Rockland county, N. Y., by Mr. Cyrus W. Field, to mark the spot where the British spy, Major

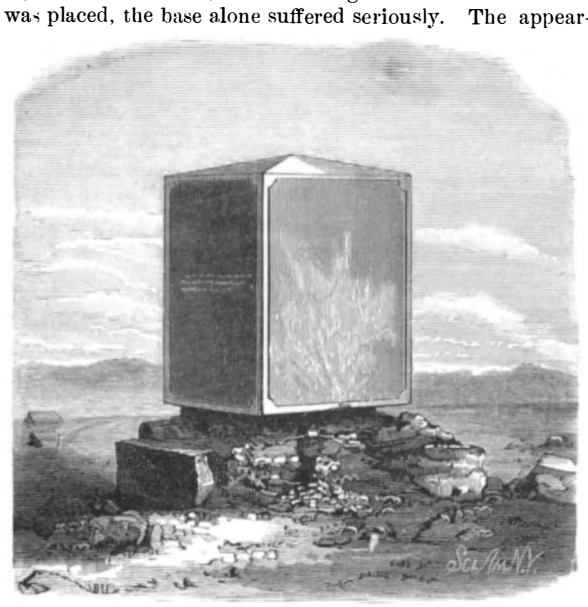


THE ANDRE MONUMENT BEFORE THE EXPLOSION.

André, was hanged in 1780. Major André, it will be remembered, was the agent of General Clinton, commanding the British forces in New York, in his negotiation with the traitor Arnold for the surrender of the important American position at West Point, on the Hudson. On his way back to New York, Major André was captured at Tarrytown; and, his errand being discovered, he was taken across the river to Washington's headquarters at Tappan, where he was tried and executed.

For some reason—probably a personal spite against Mr. Field—two attempts have lately been made to destroy the proper memorial which he had placed upon the historic spot of André's execution.

The first time the inscription was battered and partly obliterated. The next attempt would appear to have been made with a dynamite cartridge, placed upon the base, with the expectation, probably, that the explosion would overturn or shatter the main granite block. The vandal must have had but little knowledge of the action of high explosives under such conditions, or he would have placed the cartridge on the top of the monument, thus assuring its destruction. As it was placed, the base alone suffered seriously. The appear-



THE ANDRE MONUMENT AFTER THE EXPLOSION.

ance of the monument before and after the explosion may be seen in the accompanying cuts. The downward thrust of a dynamite explosion in air is strikingly shown in the smashing of the base, while the adjacent stone was but slightly injured.

Wood Carving in New York.

A marked and rapid increase has been made during the past ten years in the demand for fine wood carving, and with it a corresponding increase in the number of skilled workmen employed. Ten years ago the hundred skilled wood-carvers in the city were almost wholly engaged upon fine furniture. Now nearly six hundred carvers are at work for two firms, and as many as a thousand accomplished artists find employment in the city, the larger part of them upon the interior decoration of houses.

A writer for the *Evening Post*, who has lately investigated this (for us) new industry, says that the rapid immigration of skilled carvers from Europe has had the effect of reducing wages considerably yet they are still good. The very finest workmen, especially those in the possession of some secret processes of doing difficult work, receive wages as high as eight dollars a day. The average pay of good wood carvers is from four to five dollars a day. The process of ebonizing cherry-wood, for instance, used by one of the firms visited, is a secret known only to the workman who does it. Even the members of the firm have no right to ask what his secret is. The fact that he can get a finer, more ebony-like surface than any other man gives him a high value at once. Although the use of mechanical devices for carving wood are so much disliked by the best workmen that sandpaper is forbidden, machinery is now used to cut away the rough parts of a bit of carving. A peculiar tool driven by steam power eats out the wood wherever it goes, and thus a skillful man blocks out in a rough way as much work in a day as twenty men could have done formerly.

The delicacy and lightness of wood-carving, and the good pay which fair workmen receive for it, have already attracted many American apprentices, who, untrammeled by union rules, are making rapid headway, and promise to surpass the foreigners.

Avalanches in Nevada.

Several mining towns in Nevada suffered severely by avalanches during the month of March. The snow falls were excessive—from five to seven feet in the valleys, and more on the mountains—and slides from the steep mountain-sides were frequent. A considerable portion of the village of Genoa, Nevada, was wrecked on the 16th, and many of the inhabitants were killed or injured.

The slide came down the gorge immediately south of Genoa cañon, and swept everything before it as far as Main street. No obstacle seemed to check this moving mountain of snow until it spread out and lost its force on the nearly level piece of land on which Genoa is built, fully a quarter of a mile from the base of the mountain.

During the same storm scores of avalanches fell in and near the town of Lundy, in the Homer mining district. Some fifty or more persons were buried, and several of them killed.

The first avalanche at Lundy, on the afternoon of Wednesday, March 15, was shot over a lofty precipice near the top of Mount Scowden, which rises to a height of 2,500 feet between and at the confluence of Lake and Mill Creek Cañons, overlooking the southern section of the town of Lundy. This body of loose, dry snow dropped about 800 feet, where it struck upon a bench of the mountain, bounded out upon the air compressed beneath it, sailed over the tops of the tallest pines, and came down, vertically, 1,500 feet from its last point of contact with the earth. Several residences were buried by the snow; but no lives were lost. A second avalanche at the same place was still more terrifying. It started from a cliff overhanging the business center of the town, where no snow-slide has ever been known to occur. Three-fourths of the population were in the streets in the course of the avalanche when it started, and they could not flee, as the snow was five feet deep and soft. Fortunately, the slide struck upon a broad and elongated rock mound or bench projecting from the mountain near its base and burst into a cloud of spray, or rather the compact snow was disintegrated and sent whirling with the velocity of fine shot from a gun, the rush of air created by the avalanche being sufficient to lift men from their feet and knock them several steps, and to drive the fine snow into planks of the building on the opposite side of the street.

An avalanche that shot down Mount Discovery, on the west side of Lake Cañon, at 11 o'clock Wednesday night, buried many persons, swept away cabins and mining works, and covered the bodies of some of its victims to a depth of 45 feet. This slide was one-fourth of a mile in width, had run entirely across the cañon, and 500 feet up the steep mountain on the other side.

Many other avalanches occurred on Wednesday night and Thursday, some of them huge ones, that did great damage. Friday morning opened with a clear sky and a stiff, cold wind from the west. Just as the sun was pouring its welcome light into the cañon, and the sleepless inhabitants had assembled on the sidewalk to bid it welcome, three huge avalanches, running parallel and simultaneously, went thundering down the northern slope of Mount Gilcrest, striking the ice of Lake Lundy, and shooting across half a mile to the other shore. The sun had not yet struck the surface of the lake, but as immense clouds of fine, dry snow from the avalanches filled the air the full width of the cañon, the sun poured through and turned the whole mass to eddying gold dust. Shortly afterward two other avalanches of huge proportions had a race into the cañon from the south side—one from Deer Cañon and the other from the side of the mountain just east of it. The first named had a run of two miles before reaching the open country. On reaching the open moraine, it spread out like a pigeon's tail, to a width of nearly half a mile, and rolled down in a huge wall of snow, 300 or 400 feet high. In a space of one hour and a half no less than nine ponderous avalanches were witnessed from the town, some of them running clear across Lake Lundy, and one crossing the creek below.

EXPLOSION OF CARBON BISULPHIDE.—A fatal explosion recently occurred at Bradford, Eng., due to the escape of carbon bisulphide into the public sewer. It appears to have come from a grease works where it had been used in the extraction of oil from seeds.

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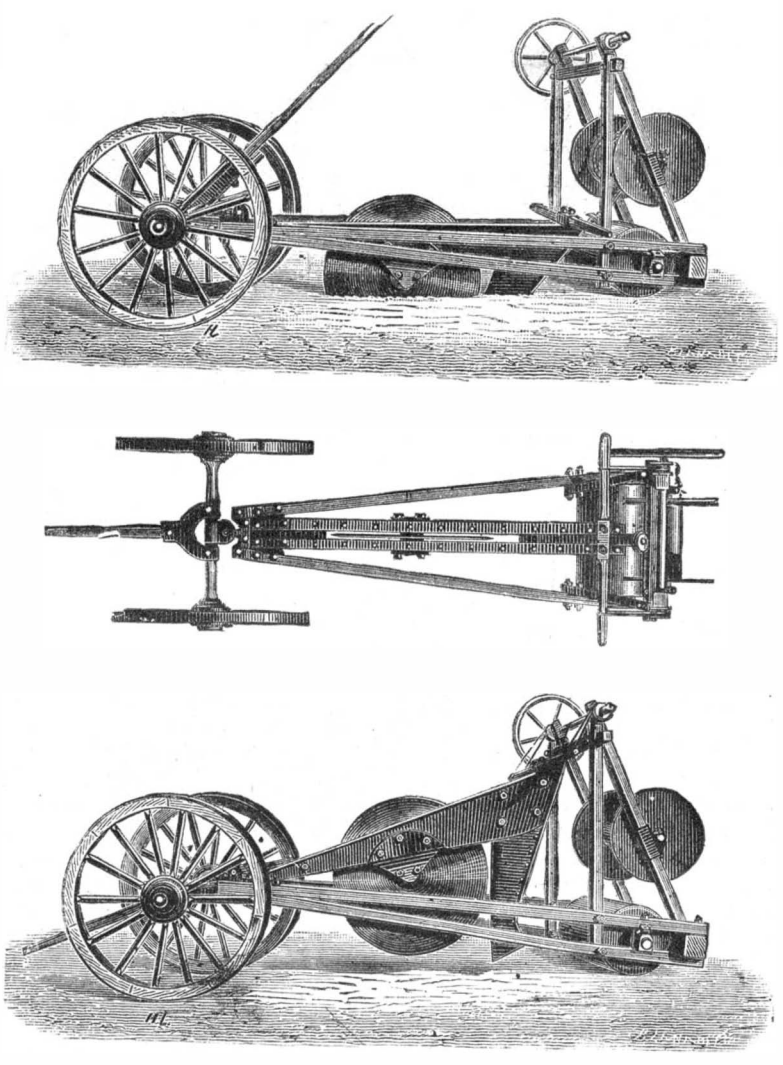
PLOW FOR LAYING ELECTRIC CABLES.

Electrical communications are constantly multiplying, and this movement is seen every day increasing in rapidity. The invention of the telephone, and its more and more frequent applications, has necessitated the laying of very numerous conductors, and is constantly requiring a greater quantity of them. In such installations air lines will probably be in the majority, since they are economical, easily put up, and readily watched. But on another hand, they are exposed to the inclemency of the seasons and to being tampered with by malicious persons, and are subject to get out of order. It is certain, then, that in many cases subterranean lines will be employed. The principal drawback to these latter is particularly that of their greater cost. The cables need careful insulation, and putting them in place is quite a laborious operation. The latter offers particularly the inconvenience that, in addition to expense, it requires time. In certain cases, in war, for example, a great advantage would accrue from the use of subterranean lines, but it is rarely possible to lay them, since there is no time to do so.

Instruments adopted for facilitating and hastening the operation of laying underground cables have been invented, and these naturally present themselves under a form similar to that of a plow—the principal work being to open a sufficiently deep trench. This is the operation that is really onerous, and it is because of the cost of it that hitherto subterranean lines have been employed only in cases where several of them could be laid in the same trench. At the recent Electrical Exhibition there were shown two types of plows adopted for the purpose just indicated. One of these, in the German section, was light and incapable of reaching much depth. There is reason to believe that it was invented principally for military purposes, and that it was designed to quickly lay a temporary line. Such being the case, the utility of the instrument is not very great, for the chief interest is to have an apparatus capable of laying a permanent line. And such is the object attained by the other plow that the Exhibition has shown us, and which is the invention of a French engineer, Mr. Jules Bourdin. We give a representation of the apparatus in the annexed figures. The manner in which it operates will be readily understood. A lenticular disk precedes the share, cuts the roots, and, in a word, opens the trench. The share is provided behind with a bent tube, and lays the cable at the very bottom of the ditch that the compressing roller in the rear afterwards closes. The machine carries a windlass frame designed for holding the coils of wire, and necessitates the attendance of but few men. The instrument is simple, strong, and well got up, and it ought to give good results. The inventor has taken care to reduce the trench to a minimum in width, while at the same time giving it a depth which, it appears, is about a meter. The circumstances that led Mr. Bourdin to devise the apparatus under consideration are quite curious. A few years ago he had to locate a system of telegraph lines between the different factories and shops that lie scattered over the domains of a wealthy and active Russian property owner, General de Maltzoff. It seems that in that country it is very difficult to preserve aerial wires. The peasants have some respect for lines belonging to the government, as it would cost too dear to touch them; but private lines are constantly being damaged by them, for they do not hesitate to take the wires at any time to mend a broken cart or for any other similar purpose. It becomes absolutely necessary, therefore, to have recourse to underground lines, and it is of the utmost importance to lay them by some means that shall prove as expeditious and as inexpensive as possible. This is why Mr. Bourdin sought to solve the latter problem by the use of his plow, and it was by the aid of this apparatus that he performed the work intrusted to him.

As regards the speed with which cables may be laid by this means, we are enabled to give some account of it from information furnished us by an agriculturist. An ordinary plow, drawn by three horses, and always moving in a straight line, can make, according to his estimate, four kilometers per hour at a maximum, the furrow opened being thirty centimeters in depth. This speed could not be much exceeded even in very mellow soil, since it represents the maximum speed of horses while walking; and it is not possible to plow on a trot. However, by increasing the power of traction, the special arrangements of the wire-laying plow ought to permit the speed to be increased a little and to reach at least five kilometers per hour; and such, in fact, is the speed reached by the inventor during the work done by him in Russia. The difficulty of plowing deep resides especially in the resistance of the subsoil; and the depth of the superficial layer determines the maximum depth of the former. Very often this depth will not have to be very great; but cases will occur in which the laying of subterranean cables will be greatly facilitated by the use of the plow that we have just described.—*La Lumière Electrique.*



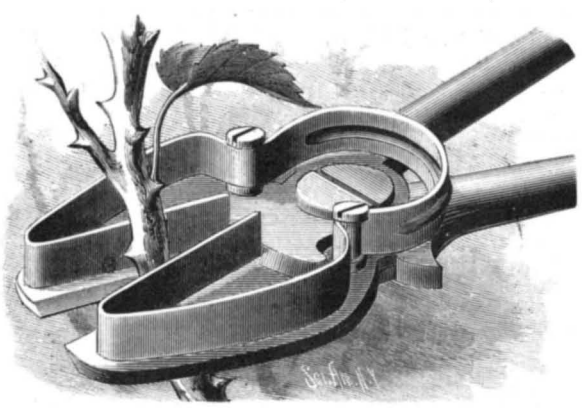
PLOW FOR LAYING ELECTRIC CABLES.

THE total production of zinc in Europe in 1880 was 203,330 tons. Germany produced 99,405 tons; Belgium, 65,010, England, 22,000; France, 13,715; and Austro-Hungary, 3,200.

NEW PLANT-TRIMMING SHEARS.

The engraving shows an improvement in scissors and shears for cutting flowers, branches, stems of plants, and fruits—such as bunches of grapes, etc. When these are cut with common scissors or shears it is necessary to hold the stem to be cut with one hand while the severance is made by the other. This being an operation compelling the use of both hands, and the stems to be cut being often wet or thorny, the task is often disagreeable and painful.

These shears are provided with a bow spring which reaches to the ends of the blades and turns inward, extending parallel with the cutting edge of the shears. When a twig or



BADIA'S SHEARS FOR CUTTING FLOWERS, FRUITS, ETC.

stem is cut off by the shears it is held between the ends of the spring, as shown in the engraving.

The invention was recently patented by Mr. Joseph S. Badia, of Philadelphia, Pa.

Sixteen Months on a Desert Island.

In the latter part of February the American corvette Marion, Commander Terry, arrived at Cape Town from Heard's Island, bringing the survivors of the crew of the American bark Trinity, thirty-three in number, who were wrecked at Heard's Island in October, 1880. The Trinity, Capt. John L. Williams, sailed from New London, Conn., June 1, 1880, bound on a whaling and sealing voyage in the Southern Ocean, and arrived at Heard's Island October 2, 1880. The bark anchored off the island, which is uninhabited, and is situated in latitude 53° south, longitude 73° east. Until October 17 all went well, but on that day, during a heavy gale, the bark dragged into four fathoms of water. The anchors had to be slipped, and the vessel was beached in order to save the lives of the crew. At the time the weather was intensely cold, and while the crew were being landed seven of them had their limbs badly frostbitten. With this exception the landing was effected without accident. The same night the Trinity floated off and was blown to sea, since which time no trace of her has been found. From October 17, 1880, the shipwrecked crew, numbering thirty-five originally, remained on the island until they were rescued. Fortunately, in landing the crew managed to save some three months' supply of provisions from the wreck. This, supplemented by sea elephant, penguin flesh, and penguin eggs, with some sea cabbage, formed the diet of the crew. On landing the captain and crew found some small wooden huts which had been placed there by various whalers who occasionally visit the place in search of sea elephants. These huts formed a most welcome shelter. During the sixteen months of their enforced captivity the sailors were engaged in hunting sea elephants. In the winter season, and, in fact, during most of the year, the men suffered much from the intense cold, and on January 30, 1881, two of the crew, named Bernard Kelly and George Watson, while out hunting, and when crossing a glacier, were overcome by the cold and were frozen to death. On the 15th of February, about 5 P.M., the forlorn crew sighted a ship standing along the coast. Signals were made to her by means of blankets, and the steamer, which proved to be the Marion, at once made for the anchorage. Early next morning the wrecked mariners were transferred to her. Heard's Island is a bleak island of volcanic origin, and is about thirty miles long by three miles wide.

Causes of Fires.

Of the fires in 1881, in which the Boston Manufacturers' Mutual Fire Insurance Company was interested, the following is a brief tabulation of causes:

Friction	34
Spontaneous	11
Unknown	10
Foreign matter	4
Sparks	3
Gas jets	2
Lamps	2
Lamps falling	2
Electric lights	2
Incendiary	2
Stove	1
Fire-cracker	1
Matches on floor	1
Emery sparks	1
Rocket	1
Lightning	1
Spark from cotton ties	1
Wood-work in contact with chimney	1
Unclassified	4
	84

MISCELLANEOUS INVENTIONS.

An improvement in medical saddle bags has been patented by Mr. George H. Carpenter, of Moorefield, W. Va. This invention is to provide for physicians in country practice, or those combining a country and town practice, an improved form of saddle-bags which may be readily converted into a hand-bag and buggy-chest. The seat piece is attached to the pouches by a hinge joint, and the saddle strap used with it is adapted for detachable connection with the pouches, so as to serve as a handle when it is desired to thus convert the saddle-bags. The pouches are formed of two parts, which are hinged together, one being adapted to stand vertically unsupported and the other to open outward, and when folded to be inclosed on the sides by the wings of the self-supporting part.

Mr. William R. Ostrander, of New York city, has patented an improvement in speaking-tube annunciators, which consists in the combination with the drop valve or cover for the mouth of a speaking tube, of a catch or latch therefor, a trip plate which swings in the speaking tube, and trips the catch for the purpose of automatically releasing the valve.

Mr. Milo L. G. Wheeler, of Oregon City, Oregon, has patented an improvement in force pumps. This is a simple and inexpensive form of pump, which may be used either for lifting or forcing water.

A novel churn dasher, patented by Mr. Robert S. Bridgman, of Charleston, Ark., has a dasher shaft formed in three or more sections, detachably connected together by screw fastenings, to which, near the lower end, are journaled parallel, horizontal, circular dashers, which are free to revolve on the dasher shaft and are detachably connected therewith, so that the dashers may be removed from the dasher shaft when desired. The dasher is formed by first drawing a series of radial lines from near the center of the dasher to near its circumference, at equal distances apart. At the outer extremity of each radial line a cord is drawn at right angles to the radial line, and each blade of the dasher thus formed has one edge bent upwardly and its opposite edge bent downwardly, so that in the downward movement of the dasher in the milk it will be revolved in one direction, and in the upward movement of the dasher it will be revolved in an opposite direction.

Mr. Carl F. Leidholdt, of Neillsville, Wis., has patented an improved artificial stone or brick to be used for building purposes. This composition consists of the following ingredients, combined in the proportions stated: hydraulic lime, one part; clear sharp sand, two parts; leached wood or coal ashes, one-half part; glue water and bone meal in sufficient quantities to give the mass such consistency that it can be molded.

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A REDISCOVERY.—"THE BLACK WHALE."

BY DR. J B. HOLDER, CURATOR OF ZOOLOGY, AMERICAN MUSEUM NATURAL HISTORY, CENTRAL PARK.

The recent occurrence of the capture of an adult baleen whale off our shores offered excellent facilities for familiar examination of the wonderful features characteristic of such great sea beasts. But an unusual interest attaches to this specimen from its being what naturalists are wont to term a rediscovery.

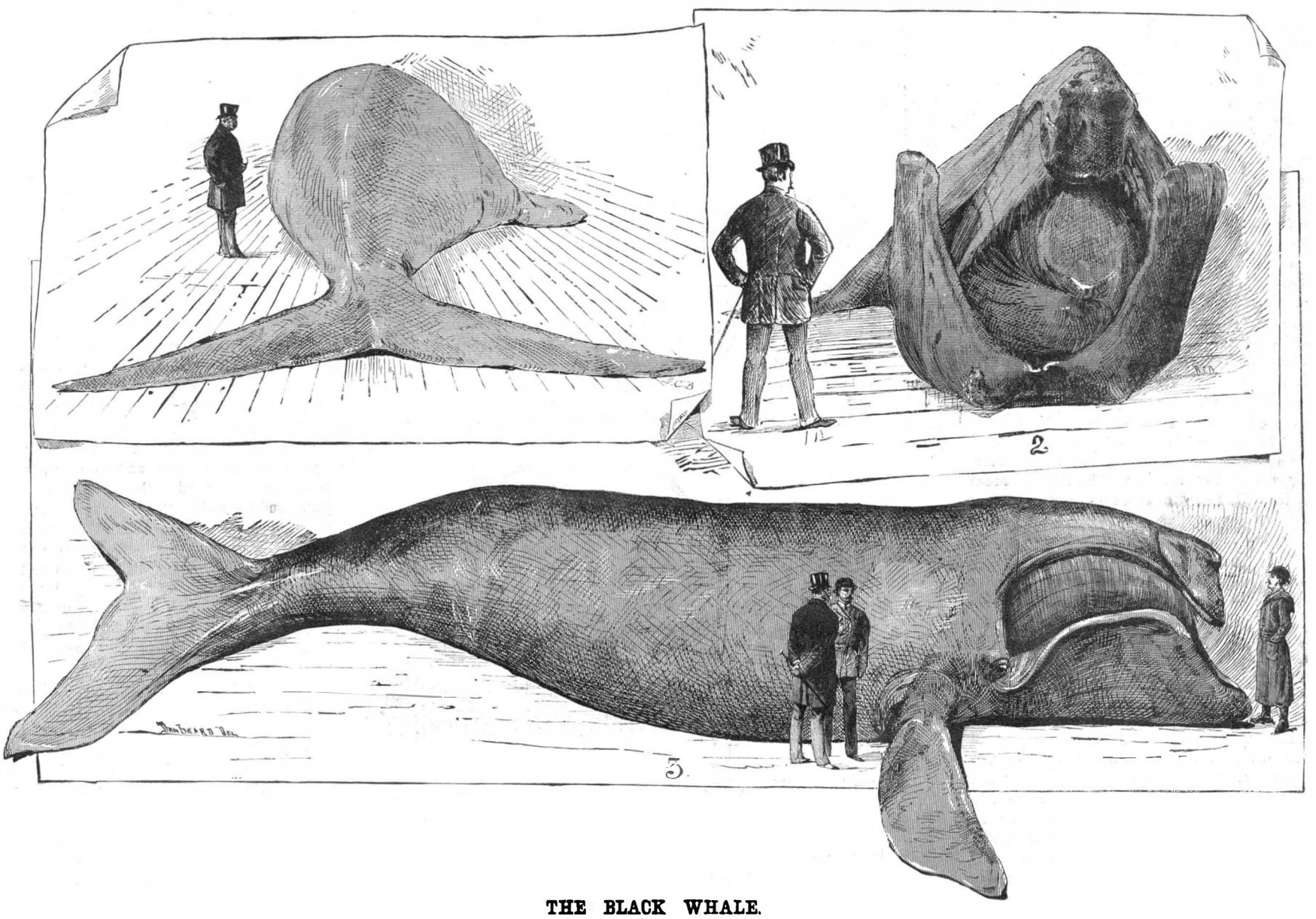
In brief, the history of this species is as follows: It is the black whale, so called in the early days of the settlement of this country, and is the one that for many years was so numerous south of Cape Cod and along the shores southward to the Delaware River. William Penn, in the year 1683, mentions the capture of eleven off that river. For many years it gave employment to a large number of whalers in Nantucket and New Bedford. The creatures were chased in boats, not far from shore, and small vessels were fitted out for the business from various points along the coast of Long Island and near the Capes of Delaware. This whale fishing became so vigorous and was pushed to such extremes that ere long the creatures were either all captured or the few that may have escaped possibly sought other waters. The species then so numerous was lost sight of, and as in those early days little attention was given to important details referring to systematic descriptions of such animals, it was lost to science until, in the year 1868, Professor Cope noticed that this whale was occasionally making visits to the waters near its old feeding grounds—its range formerly being from the Gulf of St. Lawrence to the Carolinas. The circumstance of its habitat being away from the Arctic regions, that favorite home of the two great Right whales of commerce, suggested to Professor Cope the specific name, *Cisarctica;* its generic affinities being the same as of the two larger species just mentioned, *Balæna.*

The Right whale of the North Atlantic, formerly chased by the Basque whalers, according to Eschricht, is the species *B. biscayensis*, which has also some affinity with the Right whale of the Southern Hemisphere, the *B. australis.* After closer investigation it is found that in all probability the first mentioned is one and the same with the present, now called *B. cisarctica*, though Gray, of the British Museum, stoutly maintains the contrary.

The immense size of these creatures and the few opportunities offered for examination, and also the difficulties attending a proper measurement of parts, render the task of the cetologist one of considerable uncertainty. This is seen in the glaring errors extant in all works on this subject. Though this species must have been examined many times since its reappearance, yet no account is on record that gives the characteristic external features. The anatomical differences are very marked. The American Museum of Natural History, Central Park, has a skeleton of this species of adult size. Now that we have a fine example of the whole animal at hand, we have taken the opportunity to make the most thorough and careful measurements and drawings of parts, with reference to completing its identity.

Reference to authors on the history of cetology shows many very curious as well as absurd conceptions The works of Belou and Rondelet exhibit among the first accurate and scientific delineations and text, but they knew very little of the whales. Belou, 1553, figures several dolphins accurately enough, but one especially bulky he denominates Balæna. For a long period so little was known of the animals of this order they were generally regarded and described as fishes.

The great Greenland whale (*Balæna mysticetus*)—called the Right whale—is the most familiar of the baleen species; yet a glance at the list of synonyms shows that the few other forms now known as distinct were confounded in one. The great bowhead and the Seibold whale of the northwest coast are of this genus, but are seen to have distinct specific characters. One of the most prominent external distinctions between the present *Cisarctica* and the two latter is the proportionate length of head; that of the latter is as 1 to 3⅝, while the others are as 1 to 2.



THE BLACK WHALE.

It is surprising that so much uncertainty should exist through so long a period concerning the identity of this species. A most noticeable feature seems never to have been mentioned in descriptions, and no figure is extant. The beautiful dolphin-like snout is so well marked that it is very surprising it has not been mentioned. A feature so handsome and well defined should have sufficed to render this species recognizable at once.

A glance at the literature of this subject is sufficient to see that the material at hand is very meager, most measurements and descriptions relating to the baleen, the earbones, and to the skeleton generally. The proportions of the present species are very striking as compared with those of others. We have seen that the head is a little more than one-fifth of the body in length; that of the Greenland whale being one-third.

The tail in this example measures, from tip to tip of flukes, 16 feet, and each fluke is 10 feet in length by 4 feet in width at the median line. This proportion of width of tail to the length of body greatly varies from that of the above cited species. The great size of the tail in the present species and the more slender body and smaller head altogether must credit it with greater activity. The body at the junction of the tail is but 80 inches in circumference, and a most graceful form is seen in the gradual enlargement toward the deepest point, near the head.

The whole length is about 46 feet. The length of head in an axial line from the angle of mouth to the symphysis of the lower jaws is 11½ feet.

The pectoral fins measure at their base 3 feet, in a line leading from the anterior to posterior edge over the superior surface, being, probably, about one-half the circumference. Their length is 7 feet and breadth 3 feet 10 inches.

The spiracles are situated somewhat below and behind the more prominent portion of the cranium and directly above the eyes. They are 16 inches apart at the posterior portions; 2 inches in greatest width, and a line running directly between the two terminations of the sulcus measures 12 inches, the spiracles being crescent shaped—*dos à dos.*

The space between the inner canthus of the eye and the upper lip measures 3½ inches; from the outer canthus to the nearest point of the axilla, 29 inches; from the lower eyelid to the angle of mouth, 26 inches.

The relative positions of external ear and eye are: A line drawn 7 inches in length, perpendicularly upwards from the center of the eye, subtends one sixteen inches in length which terminates in the ear.

The beak or snout is 2 feet in width at the point where the rounded process rises above it. The latter is 16 inches across its thickest portion, and maintains a uniform bulk until it is lost in the form of the head; its height at the front is 20 inches, where it is bold and handsome in proportions. The baleen plates at the deepest portion of the mouth measure between 6 and 7 feet in length and 7 inches in breadth.

The palate and tongue are of a delicate pinkish color; more deep in tone in the former. The anterior aspect of palate measures at its greatest width 16 inches, arching in Gothic figures forward to the outline of the mandible, and suddenly contracting posteriorly to a space of 3 or 4 inches. A deep sulcus extends along the median line.

The baleen plates lie about one inch apart. According to Gray, who established the genus *Eubalæna*, to which this species is referred, the baleen is "thick, not polished, with thin enamel coat on each side, and a coarse, thick fringe," these being his sub-family characters, as in part distinguishing the present from the Greenland whale. The baleen of the latter is twice the length of that of the present species, which accounts for the great depth of the under jaw and bowed upper, which latter features give rise to the trivial name *bowhead.*

A marked difference is noticeable in the anatomical characters of the various species. The number of vertebræ vary; in this there are, according to Gray, "fifty to fifty-nine." The cervical are united at their bases. This feature is common to most whales. They are, also, reduced to such thinness that the whole number thus coalesced does not occupy more room than one average cervical would naturally be supposed to.

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Though this species is the true cisarctica whale, and therefore a denizen in the more temperate latitudes of the Atlantic, yet its great rarity, from causes here mentioned, renders it unfamiliar, and it is not probably often met with by vessels crossing to Europe. The whale that is so often seen by passing vessels is a fin-back, a baleen whale having much smaller and shorter plates and a fish-like fin on the after third of the back. The profile of the whale is strikingly different from those we have considered, as the baleen being so short, the head is not proportionately large and deep. The fin-back is a very comely animal, yet fish-like in form, saving always the radical difference in tail, the whale having one of horizontal form, which is suggestive of the hinder limbs, as seen in walrus, seals, etc.

The tongue of the baleen whale is a curious mass, containing considerable oil. It is not susceptible of movement externally. The gullet is small, scarcely large enough to take in a small herring. Their food, however, is of another character, being largely the masses of jelly fishes and minute ocean forms that realize with a slight variation the words of Macbeth's soliloquy, for they do "the multitudinous seas incarnadine, making the green one red." This is true is respect of the salps, and certain lower organisms, but the Arctic seas are tinged an olive green by the extended masses of various medusæ.

The uses of the baleen will now be apparent. When we consider that masses of minute jelly-like objects are taken into the enormous open mouth of these whales, and the water unavoidably closed within the mouth must be forced out, we see the frayed edges of the baleen acting as a sieve, and the water passing out between the plates.

The eyes are remarkable for comparative dimensions, the largest being about the size of a large orange. They are beautiful organs, being possessed of all the prominent features of the typical eye of mammals, having lids and lashes; and they are said to have acuteness of vision equal to any other animal. The eye is so placed that it commands a view from every point.

The internal ear is like that of other mammals, but the external part is reduced to a mere orifice, just large enough to take in a pen-holder. The sense of hearing is, however, acute.

These whales are regarded as silent as to voice, though a roaring sound is heard when the creature is hard pushed, which is thought to proceed from the blowing hastily repeated.

They have but one cub at a birth, though, as is the case in other mammals, twins sometimes appear. The teats are situated on the abdomen, about two feet apart. They are not prominent, the glands being concealed internally. The young at birth are said to be nearly one-fourth the size of the mother. The milk is remarkably rich.

The baleen of commerce is denominated whale fin. At various periods this portion has been no inconsiderable part of the profitable results of the whale hunting. The baleen of the present example is said to be worth over one thousand dollars.

A New Race of People in Russia.

In the *Revue Scientifique*, Mr. G. Le Bon treats at some length of a hitherto unknown people inhabiting an obscure part of Russia. Peculiar circumstances having induced the author to visit the Tatras Mountains, a very curious and beautiful region, and one very little known, since he was apparently the first to traverse it, he found there a territory surrounded on all sides by steep mountains and inhabited by a people speaking a different language from the nations surrounding them and with whom they had no intercourse. These people, although less than a century ago given up to brigandage, as the author learned in his study of them, are now very industrious and honest. In spite of a climate so harsh that it would be necessary to go to the extreme north to find a similar one; in spite of a very infertile soil; and in spite of an almost Lacedæmonian diet, consisting mainly of oats, milk, and water, they are living in a most remarkable state of prosperity. They are clearly distinguished from all their neighbors in their external aspect, in their quick intelligence, and in their artistic and literary tendencies.

The villages inhabited by these new people are situated in the territory called Podhale, at the foot of the above-named mountains. This territory, as before stated, being surrounded on all sides by steep mountains, difficult of access, is almost as isolated from the rest of the world as if it were an island in mid-ocean.

As regards its origin, Mr. Le Bon thinks the original stock was Polish, which in past ages became intermixed with individuals coming from different peoples. In isolating itself more and more, and not uniting with outsiders, and in constantly being submitted to the action of the same environment and of the same selection, the primitive agglomeration has become more and more homogeneous and finally formed a new race, whose homogeneity may possibly still increase, but which already possesses common hereditary characters that permit it to be clearly differentiated from all surrounding races.

Singular Freak of a Sheep Dog.

A correspondent writes: "One of Sir George Wombwell's Yorkshire tenants reports a remarkable occurrence from the locality of Newburghe Park. A sheep dog belonging to this person a short while ago presented her owner with five puppies. Shortly after the puppies were discovered the mother was seen acting in a mysterious manner in the vicinity of an old oak tree in the neighborhood. As this conduct was repeated, an examination of the tree, which was a hollow one, was made. Inside the trunk were found a vixen fox and five cubs. The vulps were left in their lair, but next morning, on the place again being examined, all the lot had disappeared, and shortly afterward one of the cubs was found, apparently quite at home, with the puppies in the kennel. Whether the sheep dog had carried off the cub to her own offspring with the intention of appropriating the rest of the vixen's progeny in the dam's absence, and whether the vixen, finding one of her cubs minus, sought safer quarters or not, is a matter for the curious to settle."—*Land and Water.*

The Plants Found on the Mummies Near Thebes.

Dr. Schweinfurth, the celebrated explorer of tropical Africa, having examined the dried plants found on the mummies discovered last year in a cave near Thebes, has identified them, and gives the following account of them in a letter published in *La Nature:*

"I have examined the garlands which covered the breast of the mummy of King Aames I., which formed part of the great 'find' of Deir el-Bahari. The garlands are composed of the leaves of the Egyptian willow (*Salix safsaf*) folded twice and sewed, one alongside of another, along one of those branches which form the spadix of the date tree, in such a way as to form clasps which held isolated flowers inserted between the folds.

"In the breast garlands of King Aames I., these flowers are those of the *Acacia nilotica*, *Nymphæa cærulea* in isolated petals, *Alcea ficifolia*, and, finally, of a *Delphinium* which I believe to be the *Orientale*. Please send me a few dried flowers of this latter species in order that I may be certain of the identity.

"The garlands of the other kings contain flowers of *Carthamus tinctorius*; and the leaves folded into clasps are those of *Mimusops kummel*.

"In the coffin of Neb-Seni, high priest of the XXth dynasty, there were also found leaves of the common watermelon (*Cucumis citrullus*). These leaves and flowers date from some centuries before the epoch of the Trojan war. I have preserved a large number of them by moistening them, putting them afterwards into alcohol, and then spreading them out and drying them. They thus form a small herbarium of plants thirty-five centuries old. What is remarkable is the preservation of the color of the chlorophyl—violet in the *Delphinium* and green in the water melon."

Salix safsaf, *Acacia nilotica*, and *Nymphæa cærulea* still grow spontaneously at the present day in Egypt, their geographical range also embracing tropical Africa. *Mimusops kummel* has in our time been observed only in Abyssinia. *Delphinium orientale*, a species of larkspur very near *D. ajacis*, the common garden species, is spread throughout the entire East, but appears to be found only sporadically in Northern Africa, where it is cultivated as an ornamental plant, and where it was likewise so cultivated in that remote period if its identity with the flowers on the mummies be confirmed. Finally, *Carthamus tinctorius* is still cultivated at the present day in Egypt and in the entire East as a dye plant. It is unknown in a wild state, but Mr. A. De Candolle thinks that its native country may well have been the central plateau of Arabia Felix. Outside of the marvelous preservation of these delicate flowers and their color, due without doubt to the complete absence of light and humidity in the cavern in which they were inclosed, we have thus a new example of species, some of them spontaneous and others cultivated, which, for a long series of ages, have undergone no variation.

A Threatening Pest.

An insect, known in South Africa as the Australian bug, was unintentionally introduced four years ago into the Government Botanical Gardens at Cape Town. It multiplied with alarming rapidity, and already has done much damage to forest and fruit trees. Some handsome oak trees in the grounds of Government House at Cape Town, said to be a hundred years old, were reduced to such a state that they had to be cut down. It is particularly hostile to fruit trees, and on a single estate destroyed 600 orange trees. As yet no means of stopping the spread of the pest have been devised; but, as it has been noticed that it does not attack the Australian gum trees planted in the Cape Colony, it has been suggested that by a judicious intermixture of these with the fruit and other trees liable to its ravages the latter may be stopped. A better plan would probably be to import from Australia the natural enemies of the "bug"—birds or insects, as observation may indicate.

The Total Solar Eclipse of May.

The central line in the eclipse of May 17 passes near to Teheran, in which longitude the duration of totality will be within five seconds of the maximum. Taking the position of the Indo-European Telegraph Station in longitude 3h. 25m. 41·7s. east of Greenwich, and latitude 35° 41' 7", as determined by the Russian General Stebnitsky, it appears that the central line will pass between nine and ten English miles south of the station. At Shanghai, the eclipse is partial, magnitude 0·996 at 5h. 21m. P.M. local mean time; the central line runs some fifteen or sixteen miles north of that place; the sun at an altitude of 17°. At the observatory of Zi-ka-Wei, the eclipse is also partial, magnitude 0·994. In Cairo, upward of nine-tenths of the sun's diameter are covered.

MECHANICAL INVENTIONS.

A novel knot-tying device for grain binders has been patented by Messrs. Rossco Chamberlain and Josiah Austin of East Liberty, Ohio. This invention relates to knot tying devices in which a rotary head is employed; and it consists in a hollow rotary head provided with a pair of oscillating armed segments and an oscillating guide lever.

In gathering oysters from the bottom of the river by dredges the dredges are dragged along the bottom by the headway of the vessel, and if any obstruction be met with a violent back movement is produced at the windlass, which is likely to injure or kill the men at the cranks. Mr. Sumner W. Dana, of Crisfield, Md., has patented an improvement upon that form of dredge winder in which a rotary shaft bearing a clutch moves the latter longitudinally away from the winding drum (whenever a back strain occurs) by the engagement of a pin on the shaft with a cam slot in a sleeve encircling the shaft and held rigid by a pawl.

An improvement in wagon hubs has been patented by Mr. John A. Hudgens, of Pine Bluff, Ark. This invention relates to improvements in a wagon hub for which Letters Patent were granted to the same inventor, November 8, 1881, No. 249,358. The improvements consist in hollowing out the inner faces of both hub collars, so as to form on the inner face of each hub two beveled surfaces, intersecting each other, for the reception of outwardly projecting double beveled surfaces formed on the side faces of the spokes, whereby the collars are braced by being hollowed out, and the spokes strengthened near their butts by being made larger, and the spokes more securely held in place by the double bevels on the collars and spokes.

Mr. Francis Seymour, of Paterson, N. J., has patented an improved machine for spinning, doubling, and twisting fibrous materials at a single operation. In this mechanism while the feed is arrested by the stop motion there is no positive connection between the stop mechanism and the lever carrying the feed rollers. The inventor thus avoids the necessity of accurate adjustment of the two motions which is required when the stop motion lever, feed roller lever, and shifting lever are in connection positively. This machine saves labor, economizes space and power.

Mr. Jesse A. Heydrick, of Barnhart's Mills, Pa., has patented an improvement in pumps for oil wells. The object being to throw the weight of the fluid on the packers and upper ball valve to relieve the sucker rods of the heavy weight of the fluid, and thereby lessen the danger of breaking the rods.

Paper Negatives.

The method of preparation of the paper by Messrs. Morgan & Co., of Greenwich, England, is a special one, and forms, with some of its applications, the subject of a patent. The object is to render the sensitive film, as far as possible, independent of its paper support (which may or may not be retained as the *final* support), and so to reduce the chances of granularity. The paper is, in fact, a transfer paper; that is to say, the picture after development may be removed or transferred to any other suitable surface. Briefly, says the *British Journal of Photography*, the method employed is as follows:

The paper is first of all submitted to the action of acid to remove from its pores all traces of sizing material. It then receives a layer of an emulsion of finely powdered asbestos, talc, or similar material in gelatine. When dry this is submitted to very heavy pressure under polished steel rollers; a second coating is given and the rolling repeated, after which the paper has a beautiful satin-enamel surface, to which, after a polish with a mixture of wax and resin, the sensitive gelatino-bromide emulsion is applied. The preliminary coating serves the double purpose of thoroughly isolating the gelatino-bromide from the paper, and also of causing it to detach itself easily when required; in fact, Mr. Morgan says the difficulty is sometimes to keep the film *on* the support. Extensive premises are in process of erection for the preparation of the new transfer paper, which will shortly be in the market. A portion of the patent relates to the pressure of the paper into blocks—either flat or curved—ready for exposure in the camera. By the aid of the curved surfaces it is claimed that a better marginal definition is secured, and after development the picture may be transferred to a plane surface.

Curious Effect of Water on Glass.

As well known, the glass disks of the Holtz machine become quickly inactive. Their superficial conductivity occasions an induction of the current which completely neutralizes that of the machine. For this reason it was for a long time the practice to cover the disks with an insulating varnish. That not answering, the method was tried of putting the entire apparatus under a glass case and keeping it exposed to the vapors of petroleum. Jenkins, in his treatise on electricity, says that a glass rod, which, on account of its superficial conductivity, is not a good insulator, may acquire that property if it be immersed for twenty-four hours in distilled water and be allowed to dry for the same length of time without rubbing it with anything whatever. It has occurred to Prof. Carlo Marangoni to apply this process to the revolving disks of the Holtz machine, and he has found, in fact, that when thus washed and dried the disks at once assume their maximum activity. The activity, it is true, continues to decrease, but the same thing happens likewise with varnished disks. It results, then, that it would be less expensive and less troublesome to use the method here described than to varnish the disks.—*La Nature.*

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ENGINEERING INVENTIONS.

An improved millstone driver has been patented by Mr. Amos Callahan, of Maryville, Tenn. This invention consists of a sectional driver made in two separate parts, with semicircular inner ends, connected together by plates secured to each other by angular arms having lugs, and provided with blocks of rubber inserted between the semicircular ends of the sectional driver and forming self-adjusting and elastic bearings for the driver.

An improvement in lockets and analogous articles of jewelry, more especially such as are designed and adapted for containing pictures, has been patented by Mr. William H. Blaney, of Attleborough, Mass. The improvement consists in the combination and arrangement of picture-holding slides, springs for forcing them out of the case of the locket, and catches for holding them normally retracted within the case, and also releasing them when desired.

A novel valve gear for steam engines has been patented by Mr. James O'Donnell, of Central City, Dakota Ter. This invention employs two piston valves which are rigidly connected and reciprocate simultaneously to alternately open and close the ports leading to the main cylinder of the engine. Contiguous to each valve cylinder is a steam chest containing puppet valves, which are operated to alternately admit steam into the small piston chamber, from which it passes into the main cylinder. The invention is mainly embodied in the mechanism employed to operate the puppet valves.

Mr. Alonzo J. Simmons, of Indianapolis, Ind., has recently patented some improvements in steam actuated valves for steam engines. The invention consists of a valve provided with a piston which receives its steam supply from the cylinder of the engine as the main piston nears the end of its stroke, the main piston acting as a valve for the valve piston.

Mr. Frederick A. Meyer, of New York city, has patented an improved furnace for burning liquid fuel provided with an improved gas and steam mixing chamber that has an adjustable cover or partition for regulating the size of the exit therefrom, provided also with an improved combustion chamber, located above the mixing chamber and communicating with the body of the furnace, and having air openings and dampers or registers located in novel positions relatively to the mixing and combustion chambers, thereby giving the operator better control over the temperature and character of the flame.

Photographic Paper Weights.

During the last six or eight months plain cubes of polished flint glass have been extensively sold as paper weights, and many persons familiar with the difficulty of obtaining a considerable mass of flint glass tolerably free from air bubbles and from striæ have expressed surprise that such paper weights could be sold at the extremely low prices demanded. Two sizes are in the market, one being about two inches across the face, and the other somewhat more than three inches. The cubes in question are doubtless pressed, or moulded, in the first instance, after which the six faces must be ground and polished. As the sharp edges of the cube are beveled off, there are no less than eighteen surfaces to be worked true, and polished; and it certainly becomes a matter for wonder that the article in question can be sold for a few pence.

The decoration of the lower surface of a glass paper weight with a photographic picture is by no means new, as we have frequently seen roughly made and nearly hemispherical glasses ornamented in this way. Such articles have generally a very common and unattractive appearance, owing to the distortion arising from the shape of the glass and the coarseness of the material. The cubical paper weights now in the market are so well shaped, and made of such excellent glass, that they lend themselves to the production of artistic and highly satisfactory results. But we consider it better to discard the primitive method of attaching a paper print on the glass, and either to make a collodion or a carbon positive on one face of the cube. As regards the collodion picture, no special precautions are necessary, but, as the ordinary camera and dark slide are not available, it is best to print on the sensitive collodion film directly from a reversed negative, two thin strips of card board being used to prevent actual contact between the wet film and the negative. It will be found convenient to make use of an ordinary gas flame as a source of light, as the approximate parallelism of the rays serves to compensate for the circumstance that the negative and sensitive film were not in thorough contact. Either portraits or views may generally be vignetted with advantage, and an ordinary gold and acetate bath can be used for toning. A mere coating of varnish serves to protect the film, and over the varnish a layer of flake white paint may be applied.

It is, however, easier and more convenient to develop a carbon or autotype print on the cube, and as the picture is to be viewed through the glass, an ordinary unreversed negative will be required. It is scarcely necessary to say that all the changes of temperature incident to the development of the carbon print must be brought about gradually in order to avoid fracture of the glass. In the case of the carbon picture, the white backing may either consist of flake white paint, or, perhaps, better still, of the phosphorescent paint which has recently been introduced into commerce. The most convenient way of using the paint is to cover the surface of the dry carbon print with the thick portion which settles to the bottom of the bottle of luminous paint, and next to rub down on this a square of glass corresponding with the face of the cube. As soon as the edges are dry, all becomes firmly fixed, and the paper weight is finished. One considerable advantage of the luminous paper weight is the ease with which it can be found in the dark; and as the photographic pictures still remain visible, they may serve as distinctive marks for each particular paper weight. Instead of using the paint, it is sometimes convenient to employ the mixture of phosphorescent sulphide of calcium and paraffin, as used by Mr. Warnerke for making his sensitometer plates; but in this case the cube must be warmed before its application. The sulphide of calcium paint cannot be used over a silver print with advantage, as the metallic image would soon become converted into sulphide.

In order to vary the style of the photographic picture, backings of gold and silver bronze may be adopted, the powders being either mixed with a suitable varnish, or melted with paraffin, as mentioned in the case of the luminous powder.—*Photo News.*

The Arlberg Tunnel.'

At a recent meeting of the Société des Ingénieurs Civils, Paris, under the presidency of M. Emile Trélat, M. Mallet presented an abstract of a paper by M. Meyer, engineer-in-chief of the railways in Western Switzerland and the Simplon, on the works of the Arlberg Tunnel. This paper is of considerable interest, and contains many particulars of this work. The tunnel is to be 10,270 m.—11,231 yards—long. The heights above datum at the ends are 1,302 m.—4,572 feet—on the east, and 1,215 m.—3,986 feet—on the west. The highest point inside the tunnel is 1,310 m.—4,298 feet—so that the longitudinal section shows a rising and a falling gradient. The height of surface above the center of the tunnel is 800 m.—2,624 feet. It was at first intended to drive an inclined shaft to the middle of the tunnel, but this was abandoned on account of its cost, and the tunnel is being driven from the two ends. The rocks to be passed through consist of crystallized and micaceous shales containing a variable proportion of quartz. The quartz is most abundant on the east, and the rock there approaches the gneiss. Mica predominates in the west, where the rocks are softer and less compact, giving rise to infiltrations of water and necessitating the use of timbering.

The English method of driving has been adopted; and the heading at the bottom is 2·75 m. wide by 2·30 m. high—9 feet by 7 feet 6 inches. Every 50 m.—55 yards—there is a chimney or upbrow communicating with a drift in the upper portion of the section 2 m. wide by 2·30 m. high—6 feet 6 inches by 7 feet 6 inches—which follows closely upon the heading. The rock drills and appliances for ventilation are driven by water power. Two systems of rock drills are in use; on the east a percussive drill worked by compressed air, and on the west a rotary drill worked by a water engine. The daily advance—24 hours—from February 1, 1881, has been 3·3 m.—10 feet 10 inches—and the cost is estimated at 34,711,000 francs—£1,388,440.

Origin of Names of Fabrics.

Many kinds of dry-goods possess old English names which are used, more or less corrupted, throughout the world. The origin of these old names are given by Sir George Birdwood as follows:

Damask is from the city of Damascus; satin from Zaytown, in China; calico from Calcutta; and muslin from Mosul.

Buckram derived its name from Bochara; fustian comes from Fostat, a city of the Middle Ages, from which the modern Cairo is descended. Taffeta and tabby from a street in Bagdad. Cambric is from Cambrai. Gauze has its name from Gaza; baize from Bajae; dimity from Damietta, and jeans from Jaen. Drugget is derived from a city in Ireland, Drogheda. Duck, from which Tucker street in Bristol is named, comes from Torque, in Normandy.

Diaper is not from D'Ypres, but from the Greek *diaspron*, figured. Velvet is from the Italian *vellute*, wolly (Latin, *vellus*—a hide or pelt). Shawl is the Sanscrit *sala*, floor, for shawls were first used as carpets and tapestry. Bandanna is from an Indian word, meaning to bind or tie, because they are tied in knots before dyeing. Chintz comes from the Hindoo word chett. Delaine is the French "of wool."

Imitation Oil Painting.

An improvement or extension of chromo-lithography, imitating the roughness of oil painting, is described as follows:

After the colors are transferred to the prepared paper from the color electrotypes, as in the old process, the picture resembles an ordinary chromo-lithograph, and is perfectly flat and smooth in appearance. In order to secure the roughness of surface and other individual marks which are the peculiar characteristics in the original oil-painting, the latter is covered with gelatine, which accurately secures an impression of all the individual surface marks of the painting. From this gelatine mould there is prepared another impression in India-rubber or other elastic substance which permits of stretching, so that the copy of the original may in the printed copy be either enlarged or reduced as desired. This India-rubber impression is afterward used to obtain a copper stereotype plate, and this in turn serves in the preparation of a negative or depressed copy plate. This plate presents an exact reproduction, in mould, of the surface of the original painting, and the depressions are filled in with pigment colors corresponding with the surface elevations of the painting. When thus arranged the prepared chromo-paper is laid upon the copper plate, and under the pressure and heat of a transfer press the pigments adhere to the prepared paper and produce all the surface effects in the original painting. Varnish is next applied, and the result is a painted color copy which is an exact color counterpart of the oil-painting, and which may subsequently be transferred from the prepared paper to either canvas, wood, or metal, at the option of the printer, to be used in preparing any number of copies. The merit of the new process is this peculiar fidelity of reproduction which renders the printed copy so like the original that it is difficult to detect the difference.

Beer in Olden Times.

In reading descriptions of the festivities in olden times we are frequently astonished, says the *Allgemeine Chemiker Zeitung*, at the extraordinary quantity of beer consumed. This makes it interesting to compare the beer of to-day with that of the last century, as given by Prof. Caspar Neuman, who died in Berlin in 1737. That his analyses deserve as much reliance as any of that day and many of the present time is seen from the character of the man, who was recognized by the Court of Berlin by appointing him as Apothecary to the Court, by the English Society of Science, as well as by the Imperial Roman Academy, *Academica Naturæ Curiosorum*, both of which made him a member, while the medical faculty at Halle gratuitously conferred upon him the doctor's degree. He was the founder of the chemical pharmacognosy, and the first apothecary and chemist who wrote his scientific works in the German language, and in this tongue he began to combat the adulteration of food and medicine with the sharpest criticism a century and a half ago.

In judging of beers he laid great stress upon the quantity of hops used. It is well known, he says, that brown beers are well provided with hops, or rather with extract of hops, while white beer, on the contrary, has either none at all or much less than the others. It is also well known that brown beers, because of the hops in them, keep much longer than the white, which are not at all durable.

Neuman examined fifteen different kinds of beer then in use in Berlin, and determined the quantity of inflammable spirits, and of extract or inspissated substantial, resinous, and mucilaginous substances. Without repeating his figures we will mention that he found from 0·85 to 2·84 per cent of alcohol; a brown Berlin dinner beer having the smallest quantity of alcohol. In Berlin white beer he found 1·70 per cent. The total average was only 1·78 per cent for all kinds. The extractive matter varied from 3·12 to 11·08 per cent, with a total average of 6·40 per cent.

Comparing these figures with the analyses of Rudolph Von Wagner of fifteen favorite beers of the present time, we have the following:

	Alcohol.	Extract.
Beer of the past	0·85 to 2·84	3·12 to 11·08
Beer of the present	3·22 to 5·72	4·78 to 9·78

AVERAGE OF FIFTEEN KINDS.

	Alcohol.	Extract.
Beer of the past	1·78	6·40
Beer of the present	4·12	6·38

The important conclusions to be drawn from this are that while formerly there were 36 parts of extractive matter to 10 of alcohol, now there are only 15·5 of extract to 10 of alcohol. In one hundred and fifty years the percentage of extract as compared with alcohol has fallen off about fifty per cent.

It will also be noticed that while the maximum percentage of alcohol was formerly 2·85, this number now corresponds to the minimum, for we only rarely meet with beers having less than 2·85 of alcohol. Formerly the chief difference in beers was found in their percentage of extractives; the white and brown Berlin beers each had 1·70 per cent alcohol, while percentage of extractive was 4·82 and 10·79 or 11 respectively. To-day more importance is attached to the alcohol than to the extractive matter.

From this it is easily seen that the beer of the past century must have been more healthful than that of the present. The comparison is more striking if we take the common beers of the present, of which twelve kinds were analyzed by the Leipsic Pharmaceutical Society and found to contain more alcohol than extractive; the alcohol varied from 4 to 6 per cent; extractive matter, 3·55 to 4·58. One city in Bavaria has even gone so far as to prohibit the brewing and selling of beer that contains over 3 per cent of alcohol and less than 5 per cent of extractive matter, which will bring it very near to the beer of the "good old times."

If we are not mistaken Boston draws the line at four per cent of alcohol for lager beer, and that which exceeds this limit is classed with "alcoholic liquors." The only practical effect of the law, however, seems to be to furnish work for the State assayer, who tests the beer, while it causes much bad feeling and dissension.

The Spectrum of the Nebula in Orion Photographed.

During the month of March Dr. Henry Draper succeeded in photographing four times the spectrum of the nebula in Orion. The same spectrum was photographed during the same month by Dr. Huggins, of England. Dr. Draper has also taken photographs of the nebula itself so as to watch for changes in it and observe whether the process of aggregation into stars can be detected. Collated with the photographs of the spectrum, they show clearly, it is said, evidences of such condensations.

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AGRICULTURAL INVENTIONS.

Mr. William Andrews, of Buffalo Grove, Iowa, has patented an improvement in horse hay forks. In this hay fork the number of parts employed is few, and the construction is simplified and cheapened. It is light and not liable to get out of order.

In the ordinary form of mould board plow the front edge of the share inclines as it extends to the rear from the point in front (which is embedded in the earth) to the landside of the previous furrow, and with this construction the point is jammed as the plow advances like a wedge into the solid earth, making the draught very great, for the reason that the point is far in advance of the relieving cutting edge which loosens and turns over the slice. To obviate this difficulty, Mr. Benjamin S. Benson, of Baltimore, Md., has invented a plow, in which he reverses the inclination of the share of the plow, and makes its forward edge first cut the slice at the wall of earth left by the previous furrow, the share then inclining to the rear deeper into the wall of earth, so that the cut is a share cut which constantly relieves itself instead of a wedging action which creates a constant jam.

Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter., has patented a hopple, consisting of curved plates inclosing or partly inclosing the legs of an animal, and having perforations which may be secured to hopple straps, the straps being connected by a twisted link chain having a swivel at each end.

An improved potato digger has been patented by Mr Hiram Strait, of Troy, N. Y. This invention is an improvement upon a potato digger described in Letters Patent No. 210,061, granted to the same inventor November 19, 1878, and which belongs to the class in which a share for opening the soil is used in combination with a rotating fingered cylinder, by which the potatoes are separated from the soil and thrown out upon the surface.

An improvement in seed planters has been patented by Mr. James W. Robertson, of Hardin, Ohio. This invention relates to seed planters in which the seeds are dropped in hills by means of a rotating axle having feed wheels rigidly secured thereon, its object being to provide an adjustable marking or check rowing device, whereby the planter shall be adapted for planting seeds in rows of greater or less distance apart.

Mr. James M. Turley, of Onion Creek, Texas, has patented an improvement in machines for planting cotton, corn, and other seeds, and for sake of economy it may be made an attachment of a cultivator frame (the cultivating devices proper being in such case detached), although the machine may be made complete in itself.

An improvement in cornstalk harvesters has been patented by Mr. William I. Ely, of Freehold, N. J. The object of this invention is to improve the construction of the cornstalk harvesters for which Letters Patent No. 232,474 were granted to the same inventor September 21, 1880, in such a manner as to make them more convenient in use and more reliable in operation.

Progress of the Northern Pacific Railroad.

The following is the latest information with regard to the material progress of the Northern Pacific Railroad and its branches. It will be seen that the great work is rapidly approaching its completion.

The track is now down in the Yellowstone Valley to a point 125 miles west of Glendive and 20 miles beyond the mouth of the Little Rosebud. The open winter has been favorable for work, and grading and track laying have scarcely been interrupted. There have been laid 90 miles of track in the Yellowstone Valley during the winter months. The company expect to reach Coulston, 225 miles west of Glendive, in the month of June, and to be at Bozeman, at the eastern slope of the Rocky Mountains, by September 1, making over 1,000 miles of completed track east of the mountains.

On the Pacific slope the road was opened last fall to Pend d'Oreille Lake. It will reach Pack River by the end of April, a distance of 245 miles from Wallula. Two hundred miles more of track are to be finished by September 30, which will bring the road to Missoula, in Western Montana, and open a continuous line of 670 miles eastward from Portland, Oregon. With the 135 miles of the Pacific Division, running to Puget Sound, this will make an aggregate of 805 miles of completed road on the Pacific slope. Work is also going forward on the Rocky Mountains division. Two tunnels, one near Helena and one at Bozeman, are being driven as rapidly as possible. The company has on hand at the Montana terminus 95 miles of steel rails, and on the Pacific side 160 miles, ready for track laying, with an additional 50 miles of steel rails on the way to the Pacific by sailing vessels.

The company is also constructing a number of branches to develop its land grant and serve as feeders to its main line.

In 1881 the company built 45 miles of the Casselton branch, diverging from the main line at Casselton, Dakota, 294 miles from St. Paul, and running to Mayville. It also graded the Little Falls and Dakota branch, from Little Falls to Morris, in Minnesota, a distance of 80 miles, the Fergus Falls and Black Hills road, from Wadena to Fergus Falls, in Minnesota, 50 miles, the Fargo and Southwestern branch, from Fargo 50 miles in a southwestern direction, and the Jamestown and Northern branch, for a distance of 25 miles. This year the company will lay the rails on the Jamestown branch and the branch from Little Falls to Morris. It has already laid the rails on the road to Fergus Falls, and will complete it this season to Breckenridge, on the Dakota boundary, 30 miles further. The Casselton branch will be extended 95 miles, to the Canada line, where a connection will be formed with the Manitoba and Southwestern, a Canadian company, owned by those who control the Northern Pacific.

At the eastern end of the main line of the Northern Pacific the road has been finished to Superior City, and is under active construction 95 miles further to the Montreal River, the boundary line between Wisconsin and Michigan, where it is to meet a road now building westward from the Straits of Mackinac. The original charter of the company authorized an eastern terminus at the Montreal River, so the road from Superior City to that point must be regarded as a part of the main line. In Montana two branches are proposed. The company will locate, and perhaps grade, this summer, a line from Billings, at the eastern base of the Rocky Mountains, 60 miles in a southwestern direction to the Yellowstone Park, and contemplates a branch from Little Blackfoot River up the Deer Lodge Valley to Butte City, the chief mining point in Montana, a town now larger than Leadville, and yielding greater returns of the precious metals. On the Pacific slope a branch is under construction diverging from the main line of the Northern Pacific at a point 50 miles north of Wallula, and running eastward to Colfax in the celebrated Palouse wheat country. By the end of the year the company will have finished about 425 miles of branches. The policy of the company in constructing branches is to let about a year intervene between the grading and the track laying. During the year's delay settlers come into the country on the assurance of the early completion of the branch, and thus by the time it is opened for business there is traffic to sustain it.

American Soap Bark and Soap Root.

The soap bark sold by every apothecary and used by all intelligent housewives for cleansing silk and other dress goods is obtained from the quillaia tree (*Quillaya saponaria*), a native of Chili. Some anxiety is expressed in *Nature* lest the supply shall fail through the indiscriminate cutting down of the trees, the demand for the bark having become considerable both for domestic use and for use by silk and wool manufacturers.

The *Colonies and India*, in drawing attention to this tree, remarks that a decoction prepared by placing a small piece of this bark and soaking it over night in water will remove in a minute or two grease from articles of clothing and leave the cloth clean and fresh as if it was new. It may also be used for cleansing hair brushes and other similar purposes under conditions in which soap and other alkalies are powerless. It is suitable for a hair wash, and is said to be largely used by French hair-dressers, though the mode of preparation is kept secret. Such a tree, it suggests, ought to be invaluable in Australia, New Zealand, Cape Colony, and other colonies where wool growing is a staple industry. *Nature* mentions among the uses to which this bark is put a preparation for giving an artificial froth or head to ales, a very small quantity put into beer that has become dead causing it to be covered with froth.

A vegetable rival to quillaia, common in our Southwestern territory and throughout Central America, is found in a species of cactus popularly known as amole. The Tucson (Arizona) *Citizen* describes the plant as having flower stalks destitute of leaves, but plentifully supplied with branches about eighteen inches long, from which flowers of white and yellow colors are suspended in the flowering season. The bulbous root is from one to six inches in diameter and from six to eighteen inches long.

A saponaceous juice is expressed from the root, and the fiber of the leaves is hackled for the manufacture of mattresses, cushions, and chair seats. The vegetable soap extracted from the root has been used by the Indians, Mexicans, and others for many years as a hair wash, and exceeds in purity our manufacture from animal substances.

The preservative qualities of the soap are well known, and its use gives the hair a fine natural glow, preventing decay of the hair, and entirely eradicating dandruff or other impurities on the scalp.

Cattle eat the leaves in the spring as a purgative. And cut into bits and thrown on water where fish abound the effect is stupefaction of the fish, when they can be easily taken.

The price among the Indians and Mexicans, who sell it in Tucson, is five cents for a bunch of two stalks interlaced (mancuerna).

For cleaning flannels the amole is found vastly superior to soap.

Tracings on Glass for the Lantern.

The following method, by Mr. George Smith, appears to be satisfactory. A piece of finely-ground glass is rubbed over with a trace of glycerine, in order to make it as transparent as possible. It is now easy to write or draw on the prepared surface with a hard and finely-pointed blacklead pencil, and the glass is so transparent that the finest details of any engraving over which it may be placed can be seen quite distinctly. The drawing having been finished, the plate is washed with water, in order to remove the glycerine, and dried. A thin coat of Canada balsam or of negative varnish now serves to render the slide permanently transparent and ready for the lantern.

Frictional Electricity.

About a year ago a white-beer brewery located at 43–45 Rheinsberger strasse, Berlin, burned, but it was soon rebuilt in a most substantial manner. Apart from the roof frame, it was constructed of stone and iron, with the floors laid in asphaltum. Located in the upper story of the malt house is a malt cleaning machine, from which the cleaned malt is conducted down, through an iron chute, to wagons in the lower stories, for distribution through the works. If the malt-cleaning machine remains a long time in operation—which frequently does occur without intermission for three weeks at a time—electricity is developed by friction of the malt in the iron chute; and in the most isolated portions of it, such is the tension of the electricity that sparks continuously flash here and there, the malt crackles throughout, and sparks fly from it to the hands of the employes. The men at first thought this was a demoniacal exhibition, until an expert calmed their fears. This gentleman, Herr Nebrlich, brought the subject before the Electro-technical Union, and the discussion thereupon caused statements from several members that they had noticed similar appearances in other breweries, etc. Dr. Werner Siemens showed how, through the existence of the asphalt floors, the malt room is so isolated from other portions of the building that it electrically resembles a Leyden jar.—*Allgemeine Versicherungs Presse.*

Grain Freight Free to Liverpool.

The speculative holding of grain at Chicago for higher prices led, in the fore part of April, to some curious results. The export of grain had been stopped, the market rates at Liverpool being lower than those of Chicago. The railway officials refused to lower their rates, saying that they saw no good reason for sacrificing their revenues to enable the promotors of "corners" to adjust questions of supply and demand between themselves and consumers. The managers of certain ocean steamship lines having steamers billed for early departure were in great straits for freight, and even begged for grain to be carried as ballast, freight free. A press dispatch from Chicago, April 7, said that the day before the agents of the Eastern lines terminal there were asked by wire if they could not furnish small cargoes on condition that no charge should be made for transporting it by water to Liverpool. Again, on the 7th, the steamship people renewed their appeal, offering as additional inducement a premium of several cents per hundred pounds to the shipper. The offer of a premium was made by the four lines running between Boston and Liverpool. No offers of so unusual a nature were received from the New York lines.

What is Aconitia?

The conviction of Dr. Lamson, in London, on the charge of murder by means of aconitia administered ostensibly as a medicine, has led to no little discussion of the nature of this violent but little understood poison.

A continental physician called attention to the fact that the drug sold under that name in France and Germany was different from and much less powerfully poisonous than the English drug. The *Lancet* says that it is true; that they differ markedly in general character and chemical composition, and also in their effects on the human system. In fact nearly a dozen kinds of aconitia are recognized, varying so much in their properties that observations made with any one of them would be applicable only to that particular specimen, and not to the others. It is generally admitted that English aconitia is seventeen times as strong as the German, but it is not uncommon to find one specimen seventy times as active as another. This discrepancy arises not only from differences in the mode of extracting the alkaloid, but also from want of care in the selection of the plants. In the British Pharmacopœia it is directed that the *Aconitum napellus* should be used, but there is only too much reason to fear that other species are not unfrequently substituted. Some manufacturers use *Aconitum paniculatum*, which is almost inert; while others, for the sake of obtaining a more active product, employ the *Aconitum ferox* the deadly Bish poison of India. Much of the aconite root now in the market is not the root of common monkshood, but is obtained from Japanese plants of undetermined species. Some specimens of aconitia are white, some are yellow, some are crystalline, and others are amorphous. It is stated on good authority that the commercial aconitia is not an alkaloid at all, but is a mixture of several different alkaloids or active principles. The whole question is still *sub judice*, and all statements respecting the properties, chemical or physiological, of aconitia, must be accepted with a certain amount of reservation.

Copyright Mark on Pottery.

On April 5, the Senate passed a bill (S. No. 1582) which allows the copyright mark to be placed on the back of designs for moulded decorative articles, tiles, plaques, or articles of pottery or metal, or in such other place as manufacturers of such wares are accustomed to put their private marks and trade marks. The revised statutes previously required the copyright mark to be placed on the face of the article. The change will be beneficial to the large and increasing and very interesting industry which has grown up in Cincinnati, Ohio; Lakeville, Ohio; Chelsea, Massachusetts; and in Pennsylvania and New Jersey, in the manufacture of pottery, vases, encaustic tiles, and ornamental works of art, like busts and medallions.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

"T. New, 32 John St. New York, has sold and applied over fifty million feet of his Prepared Roofing, the major part being placed upon manufacturing establishments." —SCIENTIFIC AMERICAN.

Agents Wanted.—None but intelligent and energetic need apply. Must furnish good recommendations, or no notice will be taken of applications. Exclusive territory will be given up to May 1. 1882. Agents are now making from $10 to $15 a day. Address, for terms, The Infallible Coin Scale Co., P. O. Box 2624, New York city.

Steam Pumps. See adv. Smith, Vaile & Co., p. 236.

Wanted—Iron Planer, about 40 inches square by 12 feet long, new or second-hand, at once. Send cuts and cash price to Bentel, Margedant & Co., Hamilton, Ohio.

Wanted—A live Salesman; a practical Sawyer and Machinist; one who can give unquestioned references as to character, habits, and ability; one acquainted with the Southwest preferred. Address T. E. J., Box 773, New York.

Wanted—The address of all principal Glass Bottle and Jar Manufacturers in the United States and Canada. Address Thorp & Belloli, San Jose, California.

Lehigh Valley Emery and Corundum Wheels are free cutting, durable, and safe. Can be adapted to all kinds of work. Write for prices, stating sizes of wheels you use. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Kochendoerfer & Urie, General Brokers, 200 Broadway, will attend to any business in New York for you.

Two Second-hand large Wood Planers for sale by Wm. M. Hawes, Fall River, Mass.

Pure Water furnished Cities, Paper Mills, Laundries, Steam Boilers, etc., by the Multifold System of the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Now Ready. Catalogue of Electrical Books; also general catalogue. E. & F. N. Spon, 446 Broome St., N. Y.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N.H.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N.J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N.H., and N.Y. city.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Gould & Eberhardt's Machinists' Tools. See adv., p. 238.

Saw Mill Machinery. Stearns Mfg. Co. See p. 221.

Supplee Steam Engine. See adv. p. 221.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Cope & Maxwell M'f'g Co.'s Pump adv., page 204.

The Sweetland Chuck. See illus. adv., p. 206.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

For the Garden and Farm.—A great variety of Seeds and Implements. Send for catalogue. Address R. H. Allen & Co., P. O. Box 376, New York city.

See Bentel, Margedant & Co.'s adv., page 237.

Pure Nickel Anodes and Salts', pure Turkey Emery', Star Glue. Greene, Tweed & Co., 118 Chambers St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 236.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 237.

Telegraph, Telephone, Elec. Light Supplies. See p. 238.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Peerless Colors for Mortar. French, Richards & Co., 409 Callowhill St., Philadelphia, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 237.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Cotton Belting, Rubber Belting, Leather Belting, and all kinds of Steam Packing. Greene, Tweed & Co., N.Y

The Medart Pat. Wrought Rim Pulley. See adv., p. 236.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 205.

Centrifugal Pumps, 100 to 35,000 gals. per min. See p. 205.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p.238.

4 to 40 H. P. Steam Engines. See adv. p. 238.

Sewing Machines and Gun Machinery in Variety. The Pratt & Whitney Co., Hartford, Conn.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 237.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) R. D. G. asks: 1. Do they generally put even number of cogs in large wheel and odd number in the pinion or small wheel? If so, why? A. Yes; to have a "hunting" cog or tooth, so that the cogs do not constantly work on same cogs of other wheel. 2. From what points is the diameter of a bevel or miter cog wheel measured? A. From the pitch line on the back, or large diameter. 3. In a bevel cog wheel, seven inches across, to run a shaft at right angles to it just three times faster, how many cogs should there be in each wheel? Will thirty in large and ten in small wheel be right? A. Yes.

(2) J. F. M. asks: 1. Is there any way to make water flow over a bank without suction or pump? A. Yes, if the bank is not too high. Use a siphon. 2. Can refuse tin—the waste in tin shops—be melted cheaply? A. No

(3) S. W. & W. ask: What is the probable difficulty—our 12x18 new engine does not give us the power it should in proportion to the smaller engine it replaced. Engine runs 150 revolutions, and boiler furnishes plenty of steam. Engine is fed by a 2 inch pipe, 28 feet long, through a 2 inch safety valve, throttle, and Judson governor, and the steam passes through four right angles, between boiler and steam chest. Is the pipe too small? If so, what size should we use, and what would be the gain of power? A. Your steam pipe is too small. It should not be less than 3 inches diameter. Probably the openings to the cylinder are too small also.

(4) G. K. asks the difference between a high pressure boiler and a low pressure. A. The general design and arrangement may be the same, but in a high pressure boiler the strength is increased in proportion to the pressure of steam to be carried.

(5) N. C. R. asks: In putting in a brace in the frame of a building, which would be the stronger, or rather, which would make the frame stronger, a brace of, say, 2x6, placed edgewise or flat? And which way is the usual manner of putting in such a brace? A. The usual and proper way is to put the greatest width vertically.

(6) C. de P. F. writes: In using some portable agricultural machinery, where it would be next to impossible to use a counter shaft, we run from a 60 inch pulley to a 20 inch, and our belt (a rubber one, it being in the weather) slips very much. Chalk has no effect, and we ruined one belt by using rosin, and I think also molasses and rosin. Both pulleys are iron turned, high in center, and the engine making as much speed as is considered safe by maker, while a few extra revolutions make it shake so as to frighten our engineer. I had thought that small pulley might be covered with leather, but no one near our place seems to know how to do it, and our engineer thinks the leather would tear off. A. Covering the small pulley with leather would help matters temporarily, but we could not advise it. It is evident your belt is too narrow for its work. The permanent cure is to get new pulleys, at least 50 per cent wider, and your belts will drive better and wear longer

(7) J. W. G. writes: Our grate bars are within a foot of the bottom of the boilers. Would we save any fuel by lowering them? A. Yes; it should be 24 inches to 30 inches, according to size of boiler. 2. We burn slack, soft coal. Would it be any advantage to admit air behind the bridge wall or over the fire to consume the carbonic oxide gases, and if so, would it be of any advantage to heat this air and force it in with a fan, providing the heat did not cost anything? A. Yes; air introduced either way would be advantageous. There is no need of heating the air. A blower must be used with judgment, or else too much air will be sent in. 3. Is it an advantage or otherwise to wet slack before throwing it on the fire? A. If a "caking" coal, dampen it; otherwise no.

(8) H. K. B. writes: The establishment to which I am attached use ordinarily bituminous coal for firing for engine for production of steam and power. They have been induced to use coke lately. Is there extra danger of burning or overheating boiler plates from use of such fuel? A. No; unless the fire be driven excessively. By enlarging your grate (if necessary) and reducing the draught, you can reduce the temperature in the furnace as you please.

(9) N. F. H. writes: I have speeded my engine up from 80 to 100 revolutions; my governor is marked 72 revolutions, now it runs 83. Should the governor still run at 72? I have trouble with my engine running too fast when doing no work. A. If you wish to run at 100 revolutions per minute, your governor should be adjusted to regulate the engine at that speed.

(10) S. F. asks: Which is best, a threaded or screw stay bolt screwed into the inside and outside sheets of the fire box of a locomotive or tubular boiler, and cold riveted at both ends of the stay, or a plain bolt without threads, riveted hot at both ends, with a thimble of wrought iron intervening between the inner and outer sheets? A. The last named, called usually socket bolts, when of equal diameter, are preferable to the screw stay. The former are, however, almost universally used on locomotives because they are more conveniently put in; but their inferior strength is compensated for by additional numbers.

(11) G. A. F. asks: Is expense the essential preventative to water being reduced to its constituents, oxygen and hydrogen, sufficient to furnish fuel in place of wood or coal? A. Yes.

(12) D. McF. asks: When sign painters letter on muslin or canvas, how do they mix or prepare their paint? The common method of mixing the paint with linseed oil, turpentine, and japan will not answer, as either of the named liquids will "spread" badly on the cloth, and a smooth even edge cannot be obtained. A. Oil and turpentine paints are used. To prevent the spreading of the paints give the cloth a coating of thin glue size, and let it dry before applying the paints.

NEW BOOKS AND PUBLICATIONS.

SPONS' ENCYCLOPÆDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. New York: F. & N. Spon. In parts, 75 cents each.

Parts 26, 27, 28, and 29, just received, contain articles on printing and engraving, resinous and gummy substances, rope and rope making, salt, silk, skins, soap, spices and condiments, starch, and sugar.

TABLES FOR THE DETERMINATION, DESCRIPTION, AND CLASSIFICATION OF MINERALS. By James C. Foye. Chicago: Jansen, McClurg & Co. 12mo, cloth, pp. 85. $1.00.

A second edition of Professor Foye's well made little handbook for the detection and study of our principal minerals.

GEOLOGICAL SURVEY OF NEW JERSEY. ANNUAL REPORT OF THE STATE GEOLOGIST FOR 1881. Trenton: John L. Murphy, printer.

The chief features of this year's report of the New Jersey Geological Survey is an admirable geological map of the State, and an elaborate discussion of the climate of New Jersey, by Professor J. C. Smock, Assistant Geologist.

HISTORY OF THE WATER SUPPLY OF THE WORLD. By Thomas J. Bell. Cincinnati: Peter G. Thompson. 8vo, paper, pp. 134. 75 cents.

A compilation condensing in a few pages many facts and statistics with regard to the water supplies of great cities, river pollution, water purification, aqueducts, reservoirs, etc. Also much information touching the possible sources of a new water system for Cincinnati.

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A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866, but at increased cost, as the specifications not being printed, must be copied by hand.

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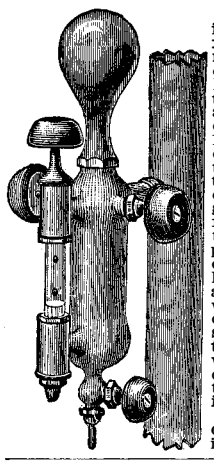

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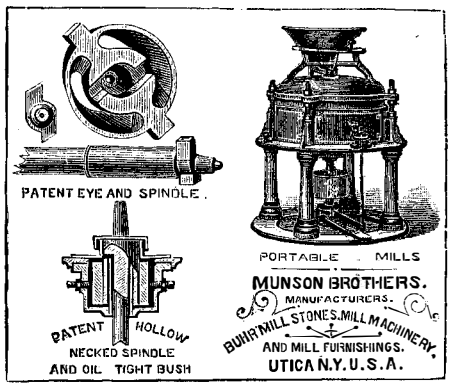
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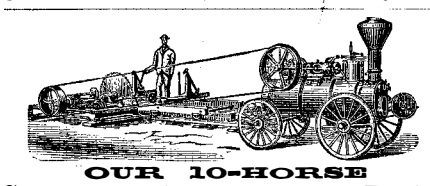

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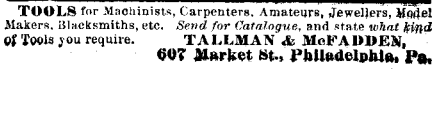

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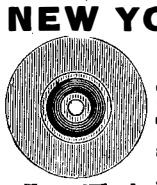
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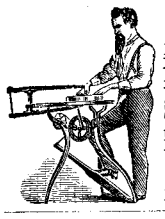

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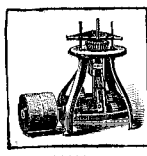

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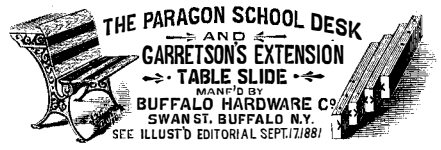

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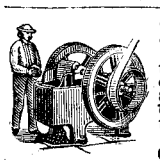

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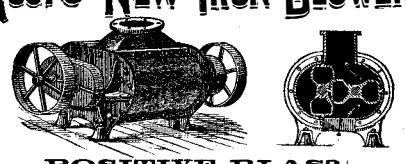

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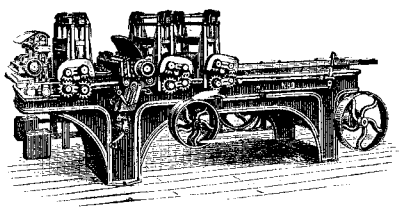

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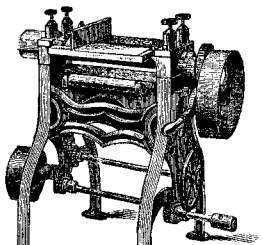

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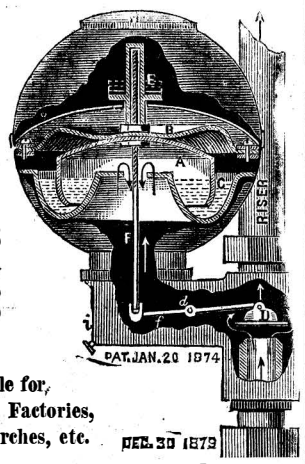

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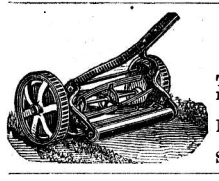

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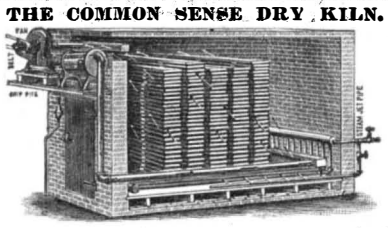

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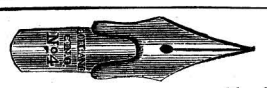

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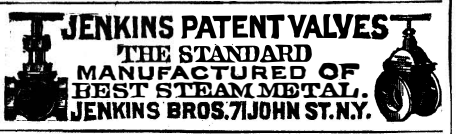

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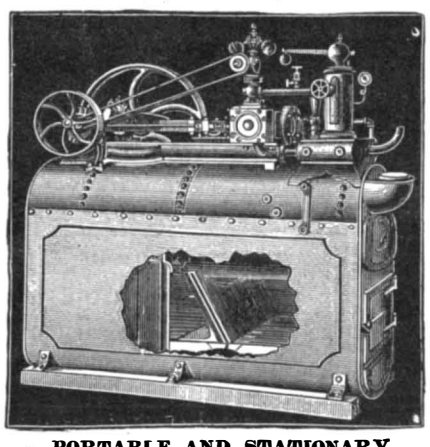

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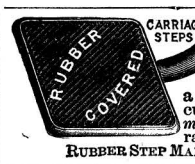

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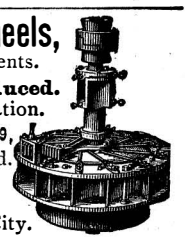

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